** FRIDEN **

CALCULATING MACHINE ----

BASIC MACHINE TRACING COURSE

BASIC MACHINE TRACING

CONTROL PLATE

SELECTION

PLUS KEY - RELATION TO SELECTION

MINUS KEY " " "

ACCUMULATION

TRANSFER

GENVA GENEVA DISC

PLUS KEY-CLUTCH RELEASE-CLOSE SWITCH-LATCH DOWN

MINUS KEY

ADD KEY-ONE CYCLE PLUS OR MINUS

RIGHT SHIFT-PRESGT-CLUTCH RELEASE-CLOSE SWITCH

LEFT SHIFT - " " " " "

CARRIAGE CLEAR " " " " "

" " -POWER SETTING-POWER ACTUATING

" " -PUSH ROD HELD IN POSITION

" " -CARRIAGE CLEAR

" " -KEY-RELEASE-LATCH-DELATCHING

COUNTER OSCILATOR

DIVISION PRESGT

REMOVING KEYBOARD

1. Remove special screws from either end of keyboard support bar.
2. On 8 Bank, remove fillister head screw from left side of keyboard, which secures bracket to keyboard and side plate.
3. Loosen hold down clamp and make 1/4 revolution to left or right -- purpose -- merely to get it out of the way.
4. Hold keyboard at top and Btm. and gently remove by lifting out.

IMPORTANT ADJUSTMENTS

*

1. Division Control Gear
2. Connector Arm
3. Timing of Add Sub gears and Selection Grs.
4. Timing of Shift gears
5. Geneva & Geneva disc
6. Shift engaging link
7. A-S gate centralizer
8. Division Aligner (8 adj) (complt)
9. Div Tabulator (all adj)

REMOVING CONTROL PLATE

1. Remove 3 snap washers forward
   " 6 " " aft
2. Remove 3 springs. (also spring on centralizer arm)
3. Remove 5 screws.
4. Remove taper pin in collar of counter Reverse Cone (Btm to top)
5. Remove taper pin in Division control gear (top to Btm)
6. Remove taper pin from Main Dr. shaft (Make 3/4 turn - remove top to Btm) Division Drive Gear--------

SPRINGS AND THEIR LOCATIONS

1129 - on counter reverse cam centralizer arm.
1015 - lower front of clutch holding pawl - remove and leave suspended on stud.
1039 - On Counter Reverse lever - remove end from Counter Reverse lever, leave other end attached.
1100 - Add and sub. gate actuating lever - remove from stud - leave suspended in lever.
Also 1039 on same machines - on stud on Div tab. lever.

LOCATION OF SNAP WASHERS

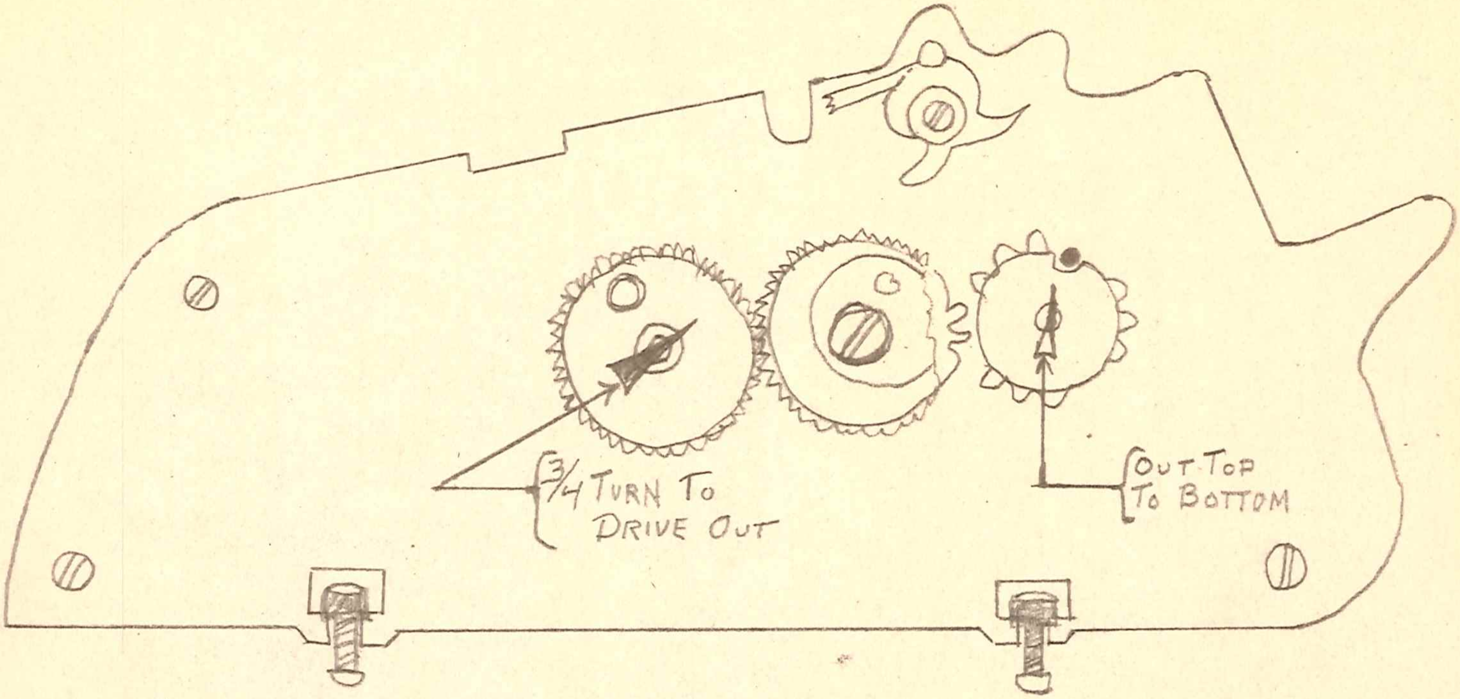
Front 1. Front end of Div Counter Reverse lever (61378)
2. Carriage clear key stem (4013 - 61425)
3. One cycle add Key lever (21195)
Rear 1. Counter Reverse Cam (64690) also remove lever 65155 and eccentric. Remove Div. Counter reverse lever and leave suspended.
2. Gate relatching link - rear extremity.
3. In center of add-sub actuating lever.
4. Snap washer on Control Plate setting directly in front of Plus-Minus Gate Control Actuating lever.
5. Div. Control Slide (upper rear)
6. Return clear Key Latch link rear extremity.

LOCATION OF SCREWS

1. Forward - Flat head screw next to right hand Div Key against Control Plate.
2. In Control Plate behind spring attached to Rt. hand Div key.
3. Same as two above on lower rear of Control Plate.

* The screws above are 6-32 x 9/32 special screws.

4. a 6-32 x 3/8 Fillister head screw holding eccentric (adj) for Counter Reverse Cam and True Quotient lever assem.
5. One screw forward securing Control Plate to Base Assem.


3/4 TURN TO
DRIVE OUT
OUT TOP
TO BOTTOM

CONTROL PLATE

REPLACEMENT OF CONTROL PLATE

1. Align Div - throwout Cam and Div Control eccentric. (to illustrated position)
2. Check fibre gear for bushing with shouldered end against gear, away from plate.
3. Check clutch for being in "home" position - it must be "home."
4. Check Div Control (60089) arm Centralizer as to whether it's seated on high-point of Div Control Unit Assembly.
(65090)

After checking above proceed to replace Control Plate - front end first positioning Carriage clear in place and clutch release slide latch assem. Proceed to replace guiding fibre gear shaft in hole.

Replace snap washers, levers, and springs. Replace screws and check out.

BASIC MACHINE TRACING OPERATIONS

These tracing operations are questions designed to lead you through the machine, operation by operation, so you may become familiar with and learn the mechanical operation of the FRIDEN CALCULATOR.

They are also designed to teach you how to trace any sequence of parts, which is most important to know in diagnosing service problems, therefore benefit by the practice you obtain on these questions.

The answers to these questions are to be written using the STW Manual which is color coded for assistance in locating the parts more easily on the machine and using the machine to actually find out how the parts operate.

Do not list unnecessary parts and operations that have no bearing on the particular operation in question. Use part names as listed in the Manual. Be sure to observe and write out every part, whether it is a Slide, Lever, Link, Stud, Spring, etc., that has any importance in making up the sequence of parts.

You will find the page references given in sequence as near as possible to the sequence of the parts in the operation.

Whenever the action or motion of the parts are described, they move to the Right, Left, Front or Rear, up or down. Shafts rotate and any extended part will move in direction as mentioned. It is as if you are always looking at the Front of the machine. If you are facing the Rear of the machine, Left would be to your Right.

1. (a) (Example) Depress a Selection Key (Main Keyboard). Trace sequence of parts that are actuated upon depression of Keystem. (Use Roto-Flow Mock up; Ref. Pg. 74, 68, (Yellow)

(Answer) When the Selection Key is depressed the Stud on Bottom of Selection Key contacts and moves the Selection Lever to the Front. The Rear of the Selection Lever has a yoke to which the Selection Gear is attached, thus bringing the Selection Gear into proper position for mesh with Actuator Teeth.

(b) How is Selection Key held in depressed position? (Ref. Pg. 74, Yellow)

(Answer) The Lock Bar is cammed to Rear when Key is depressed then brought to front by spring tension when notch in Keystem aligns with Lock Bar.

2. With Selection Key depressed, Depress Plus Key and rotate drive by Hand Crank. Observe that Accumulator Dials (Upper Dials) rotate in line with Depressed Selection Key.

   (a) Trace sequence of parts that place Add and Subtract Gate into Plus position. (Ref. Pg. 70, 71,68, Red)

   (b) Trace sequence of parts that cause the Accumulator Dials to rotate in the Add direction. Write answer from Actuator Teeth contacting Selection Gear Teeth. (Ref. Pg. 68, 77, Green)

   (c) Depress Minus Key. Trace sequence of parts that place Add-Subtract Gate into Subtract position. (Ref. Pg. 70, Yellow and Red; Pg. 68, Red)

(d) With Minus Key depressed, rotate Hand Crank and observe the Accumulator Dials rotate in a Subtract direction. Trace the sequence of parts that cause the Dials to rotate and you will notice the same parts as in 2-B, Pg. 68, Green, are actuated and they rotate in the same direction. If this is true, what part changes the direction of motion of the Accumulator Dial and how does this part do the reversing?

3. Clear the Keyboard. Clear the Dials. Place "9" in any column. Depress Plus Key, turn Crank to place the "9" in Accumulator Dial. Clear the "9" from Keyboard and place a "1" in the same column. Depress Plus Key, turn crank, observe the "9" turns to "0" and the dial to the Left turns to "1".

(a) Trace sequence of action that accomplishes this transfer. (Use Roto-Flow Mock-Up, Ref. Pg. 77, 68, Orange)

(b) What restores Transfer Gear after transfer is accomplished? (Ref. Pg. 68, Blue)

4. Remove Carriage. Depress all "1's" in Keyboard. Depress Plus Key. Rotate Crank. Observe that the Add-Subtract Gears, starting from Right to Left, begin to rotate one after the other except #1 and #2, which start rotating at the same time. (This is possible on #1 and #2 due to no transfer into the first position.)
Try other rows of Keys in Keyboard.

On the end of the Selection Gear Shaft is the Geneva and directly under it is the Geneva disc on the Actuator (Pg. 68, Brown). Observe when the Geneva stops rotating in relation to the position of the raised Islands on the Geneva Disc.

What is the purpose and function of the Geneva and the Islands on the Actuators?

Clear the Keyboard. Pull down on a Transfer Gear. Depress Plus Key. Rotate Crank. Observe position of Geneva and Islands when Transfer Gear Rotates.

What is the purpose of the Notch in Islands and purpose of Geneva and Islands.

5. (a) Depress Plus Key. Trace sequence of parts that disengage the Clutch Release Dog from the Main Clutch.
(Ref. Pg. 70, 71, 55, Dark Blue)

(b) Trace sequence of parts that close Micro-switch on same operation. (Ref. Pg. 70, 71, Dark Blue; Pg. 55, 56,54, Red)

(c) How is Plus Key latched down when Drive Shaft is rotated? (Ref. Pg. 71, Yellow; Pg. 55, Dark Blue, Yellow)

6. (a) Pull down Add Key. Trace action and positioning of parts actuated. (Ref. Pg. 69, Yellow; Pg. 55, 57, 56, Green)

(b) Selection in Keyboard. Depress Plus Key and HOLD DOWN. Turn Crank. The Keyboard clears near the end of rotation of Drive Shaft stops in Home position. (This is the One Cycle Plus and Minus Action)

Trace sequence of action that clears Keyboard. (Pg. 68, 56, 57, 74, Violet)

(c) Trace how Clutch Release Dog is allowed to engage with Clutch Dog to stop Drive Shaft (Pg. 57, Violet, Brown; Pg. 55, Brown)

7. Depress Right Shift Key.

(a) For Smooth Shift: Trace sequence of parts that position Shift Clutch Controller for engagement with Shift Driver on Rear of Actuator. (Pg. 57, 73, Orange)

(b) For Two Point Shift: Trace sequence of parts that position Shift Clutch Collar for engagement with Right Shift Drive Gear. (pg. 57, 73, Orange; Pg 81, 80, Orange)

(c) Depress Left Shift Key and observe similarity in action.

8. Depress either Shift Key and trace sequence of parts that release Clutch Release Dog from Main Clutch. (Pg. 57, Yellow)

(a) Also how Micro Switch is closed. (Pg. 57, 56, 54, Red)

9. Carriage Clear.

(a) Shift Carriage to extreme Right. Depress Carriage Clear Key.

Trace sequence of parts actuated to release Clutch Release Dog from Clutch Dog, and how Micro Switch is closed. (Ref. Pg. 69, Red; Pg. 55, Orange, and Orange Cross Lines; Pg. 56 Orange; Pg. 55, Light Green)

(b) Observing under-side of machine, Rotate Hand Crank. Observe that the Left Shift Push Rod and Auto-Clear Red are Power actuated into position on Revolution of Drive Shaft.

Release Carriage Clear Kay. Re-depress and trace sequence of action and parts that Preset into place for Power Setting of Push Rods. (Pg. 55, Orange Cross Lines; Pg. 73, Blue)

(c) Rotate Hand Crank and trace action of parts that do the Power Setting of Push Rods. (Pg. 58, 59, Orange; Pg. 73, Violet)

(d) After Push Rods are actuated into position, how are they held there? (Ref. Pg. 65, Red; Pg. 73, Red Arrow)

(e) With Carriage Clear Key depressed and rotating Hand Crank trace sequence of parts that clear the Accumulator and Counter Dials to Zero when Carriage reaches First Position. (Ref. 72, Orange; Pg. 77, 76, 77, Blue)

(f) The Carriage Clear Key is released when the Carriage reaches First Position.
Trace sequence of parts that release Key. (Page 77-72, Green Cross Lines; Pg. 57, Blue; 55, 70, Blue Cross Lines)

(g) When Carriage Clear Key is released, how is Latch #71344, Pg. 65, delatched?

10. Positioning of Counter Oscillator Arm (Wobbler) and turning of Counter Dials.

(a) Depress Plus Key, Trace sequence of Parts that position Counter Oscillator Arm (Wobbler), (Pg. 70, Red, Green), (Pg. 69, 71, Green; Pg. 56, Brown).

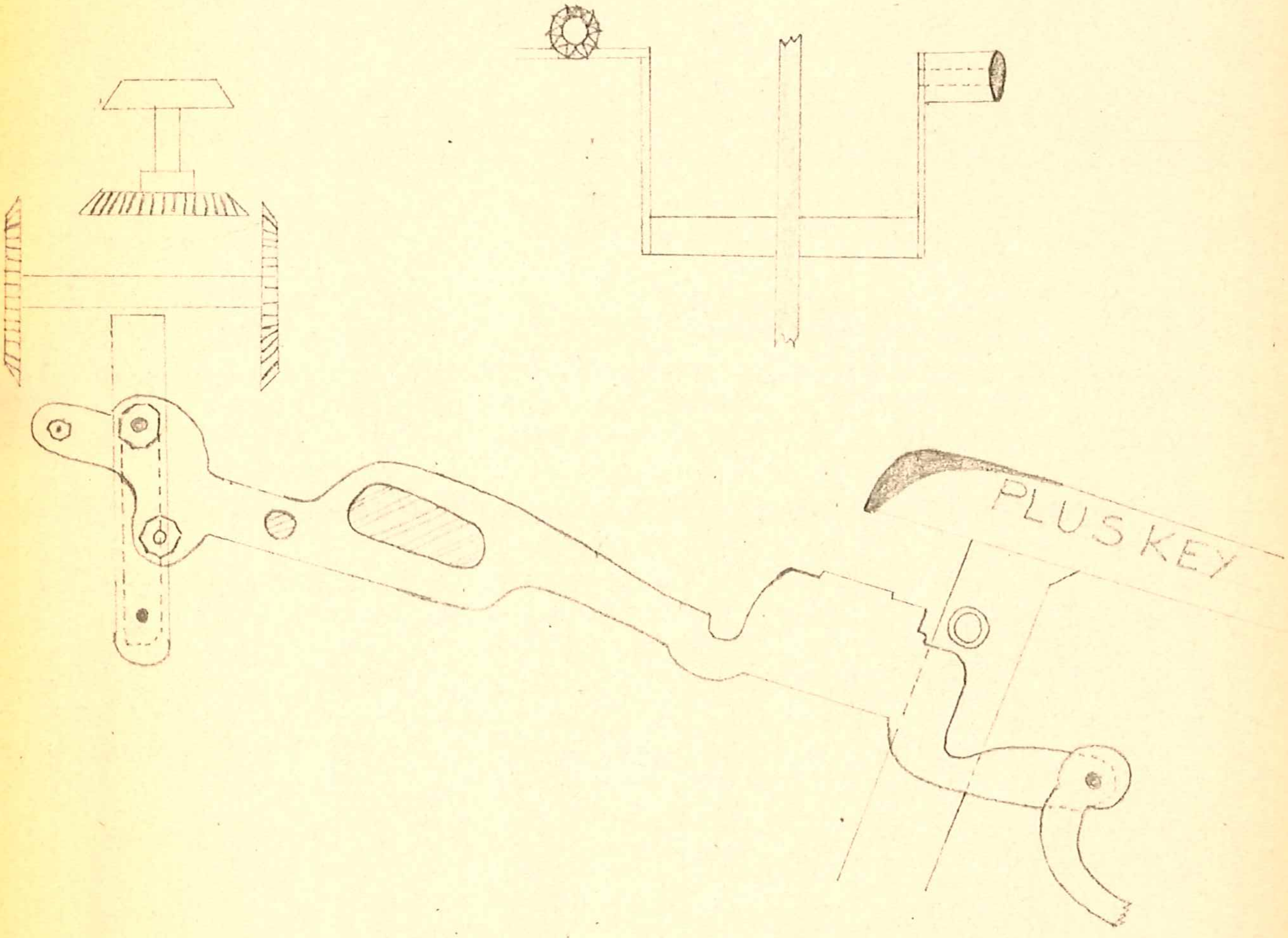
(b) Rotate Crank. Trace action of parts that cause Counter Finger to engage with Counter Dials, to turn Dials, to disengage Dial, to restore Home position. (Pg. 59, 66, Green; Pg. 77, Violet; Pg. 68, Dark Blue; Pg. 56, 66, Brown)

(c) Observe difference in positioning of "Wobbler" on Minus Key and difference in motion of Counter when rotating Crank.

2 A

Plus Key (sequence of action)

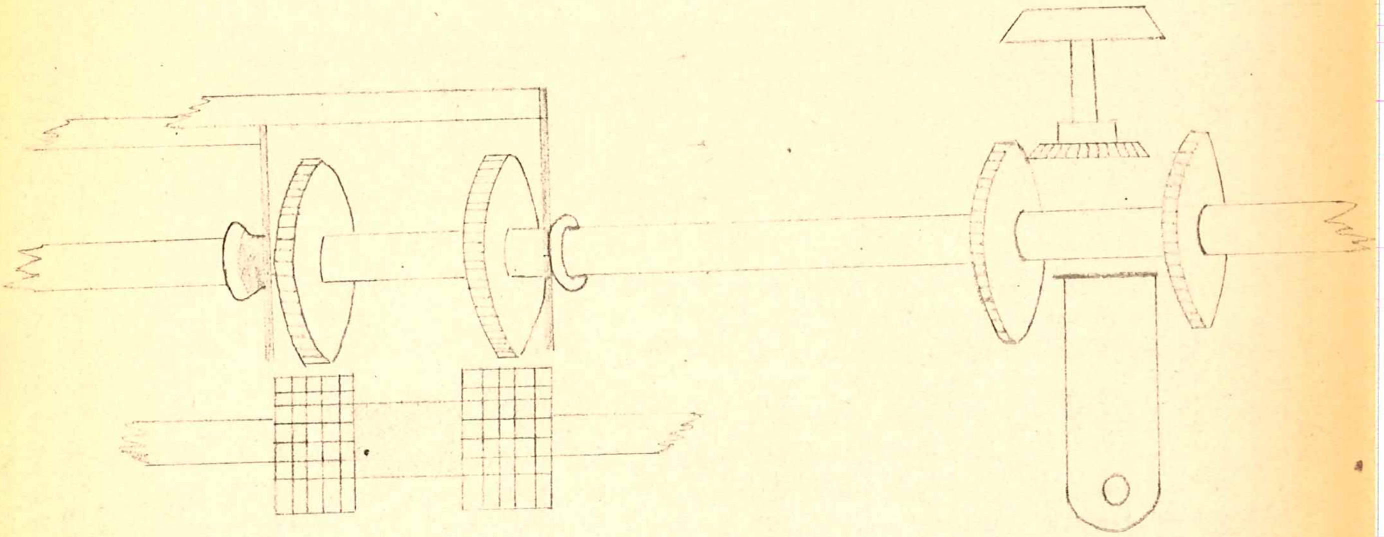
Depress your Plus Key. A stud on the key stem engages a cam surface on Division Control slide camming the slide to the rear of machine. A stud on end of slide secured in "U" shaped linkage actuates the linkage to the rear of machine which in turn moves Plus-Minus gears to the rear to engage forward side of Accumulator gears with gears in mesh you will get a positive count on Accumator Dials.


PLUS KEY

2B Plus Count of Accumulator Dial

A selection lever moves positioning the selection gear to pick up selection from Acuator gear upon meshing with it. The Actuator gears are driven from Main Drive shaft and transfer selection to selection gears through selection shaft to plus - minus gears. Selection gears and plus-minus gears all both on selection shaft. The Plus or forward gears of plus-minus gears are in mesh with Accumulator gears upon depression of Plus Key. This being so you get a counter clockwise motion for a positive count in your Accumulator dials.

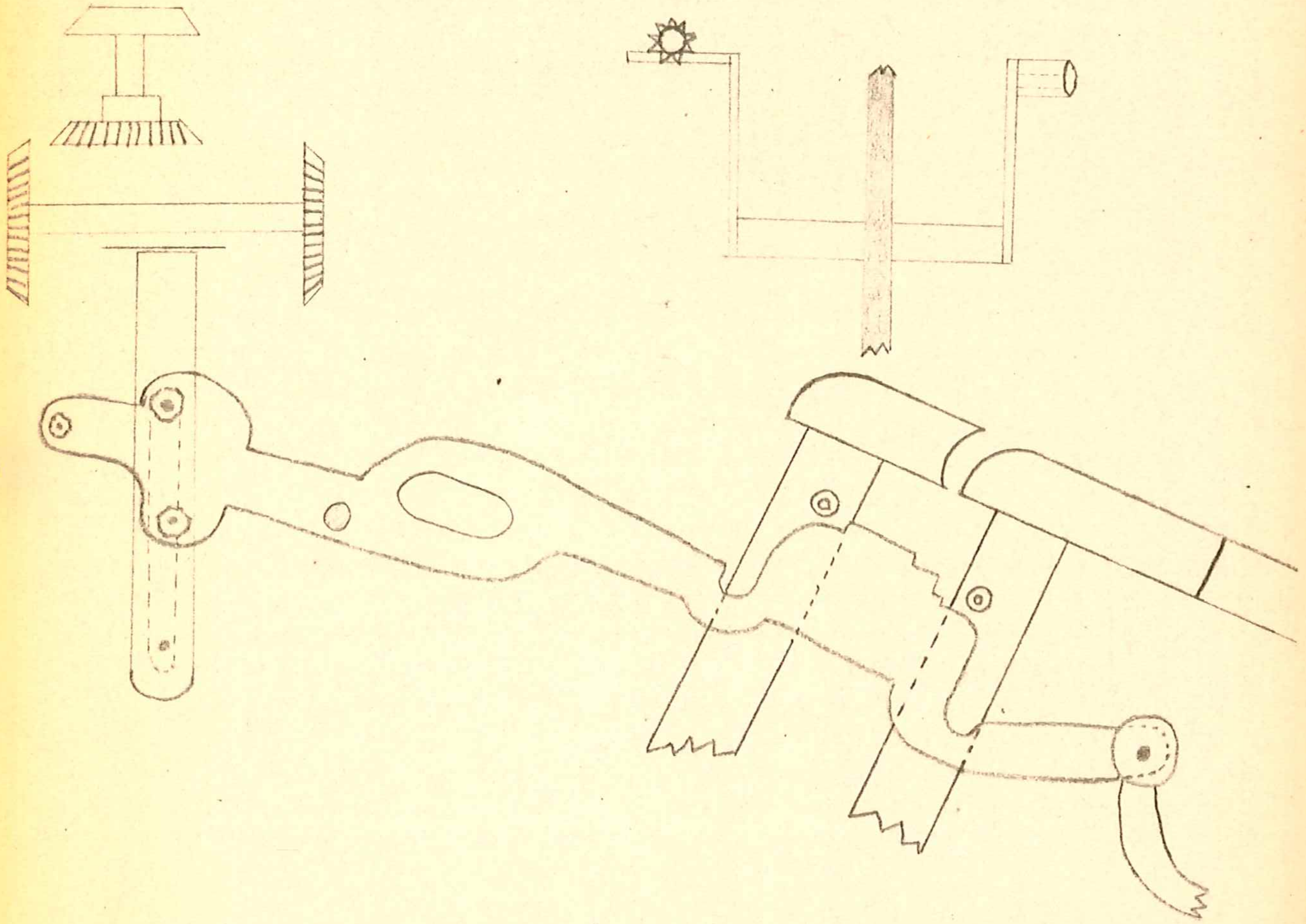
2-B



2c Minus Key (sequence of action)

On depression of Minus Key stud located of stem of Minus Key contacts cam surface on Div. Control slide comming it forward. Div Control slide in turn moves "U" shaped linkage forward. "U" shaped linkage is connected to Plus-Minus gate, therefore plus-minus gate moves forward bringing Minus gear in mesh with Accumulator dial gear rotating the dial clockwise.

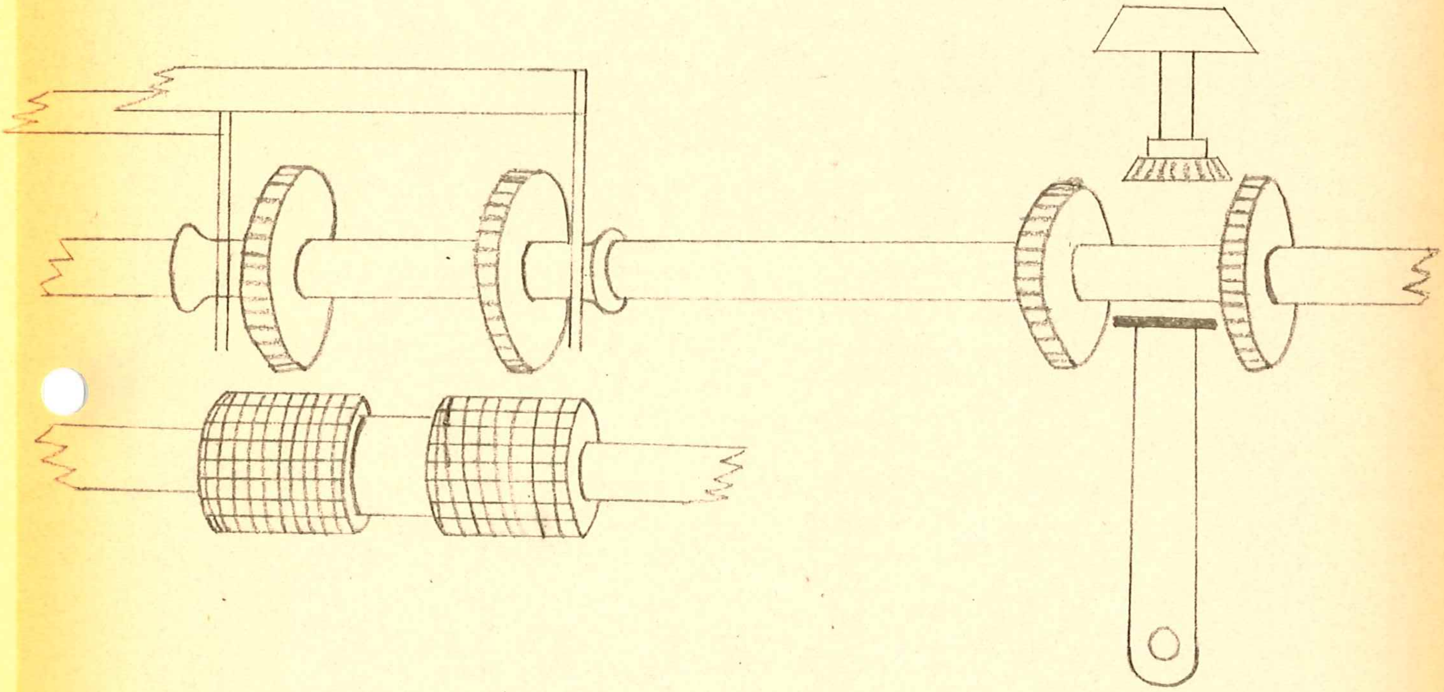
2-C



2d (Minus) Acc. Dial

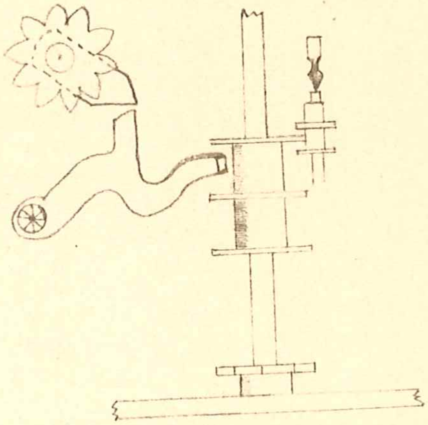
The selection is transferred from Actuator thru selection gear. selection gear shaft to plus-minus gears. On depression of your minus key, your plus-minus are moved forward so as to come in mesh with Accumulator gears on Minus or rear side of plus-minus gears. Therefore your Accumulator dials will rotate in a opposite direction because minus gear mesh on the opposite side Acc. gear does Plus gear, thus causing movement in opposite direction.

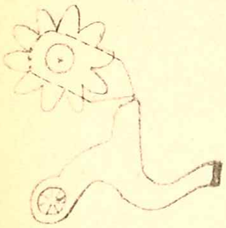
2-D

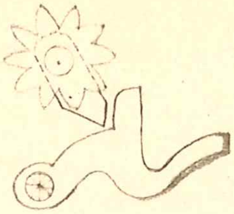


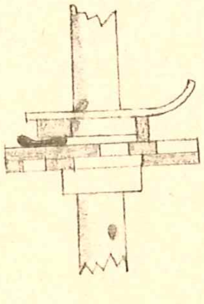
When Acc Dial passes between 9 & 0 transfer cam on Acc gear, cams rear ext. of transfer lever forward and the transfer lever being engaged in transfer gear assembly moves it forwards also. The transfer gear assembly being on next column to left. The transfer gear of trans. gear Acc. comes in mesh with transfer tooth on Geneua disc. This tooth proceeds to advance it's corresponding Acc. dial one diget, thus your transfer is made. The reston cam on Geneua disc them comes in contact with the transfer pin, pushing or restoring the transfer gear ass. rearward to it's normal position.

3-A









A. The function of the Geneua and islands is to stop the rotation of the selector gear shaft and connected parts the moment they are disingaged from the Actuator gear(ie to prevent it spinning from it's own momentum). And to insure that the Accumulator dial stops, showing the desired numbers.

The actuator gears, geneva, and geneva disc are so positioned that upon rotation of the selector gear shaft by any one of the nine actuator gears, the first island of the gevona disc is always positioned under a valley of the geneva, the momen the selector gear is released by the last tooth of the Acuator gears.

B. As a transfer is always made after the completion of an Operation of the selector the notch in the goneva disc is to permit the geneva t to make 1/10 of a turn (one digit) if and when the transfer gear is brought into operation and the second island it to prevent more or less than one tenth turn.

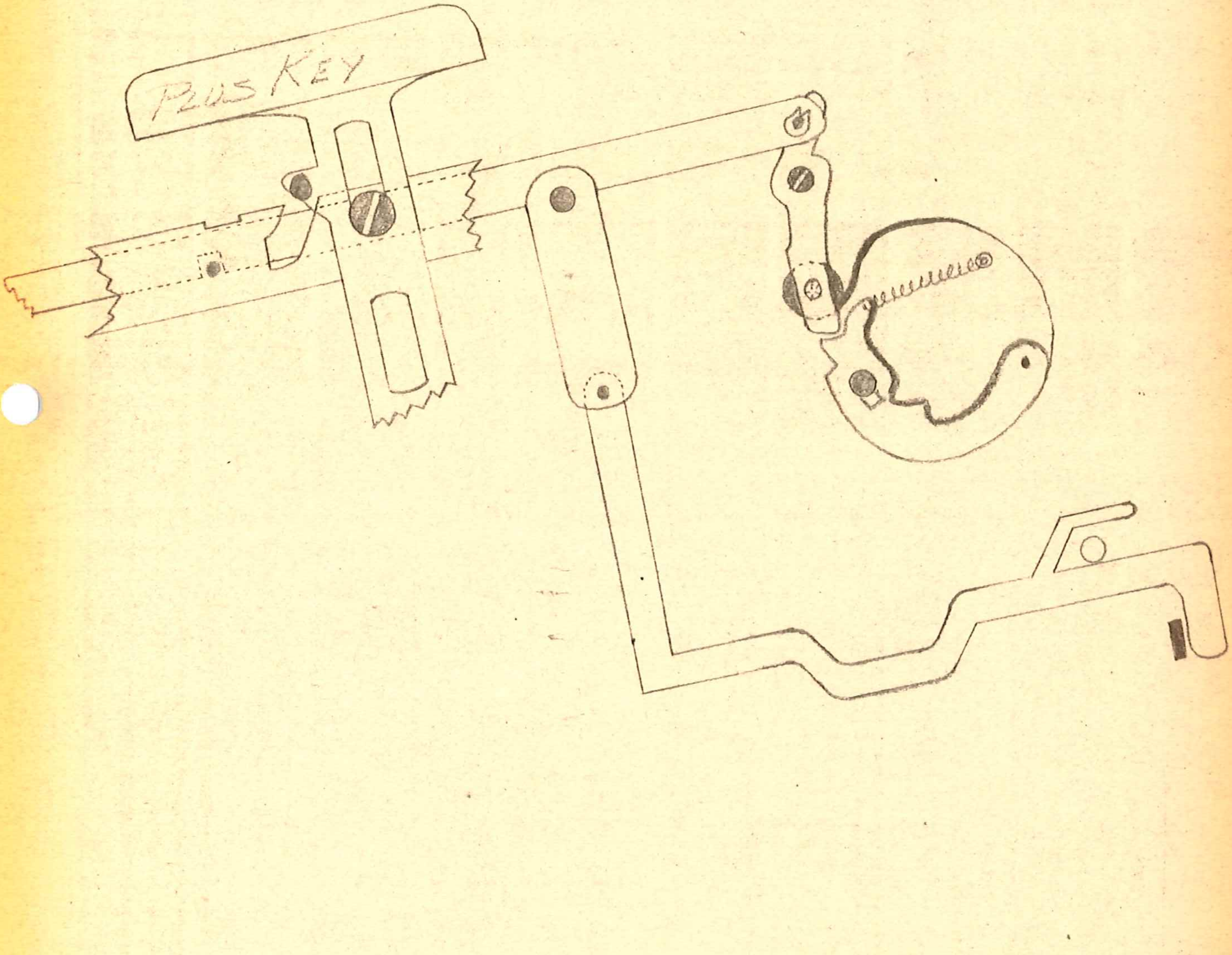
5 A, B, & C

A. On depression of Plus key, stud "A" on key stem enters notch "B" of clutch release slide camming the C.R. slide to the rear of machine. Stud "C" on C.R. slide fits into notch in clutch Release latch moving it simultaneously to the rear. As the C.R. latch moves to rear it pushes the top of clutch release dog rearward. The C.R. Dog pivots on shoulder screw "K" moving the bottom forward out of engagement with clutch Dog "E"

B. See figure (5B) (Crow's foot assy. etc.

C. Roller "J" on clutch Release Dog rolls on cam surface "H" of clutch Dog holding clutch relrease latch Assy rearward. Clutch release slide is also held rearward thru stud "C" in notch of C.R. latch. In rearward position of C.R. slide, lip "G" of notch "B" positions over stud "A" on key stem holding Plus key in a depressed position.

5-A+B



6 A, B, & C

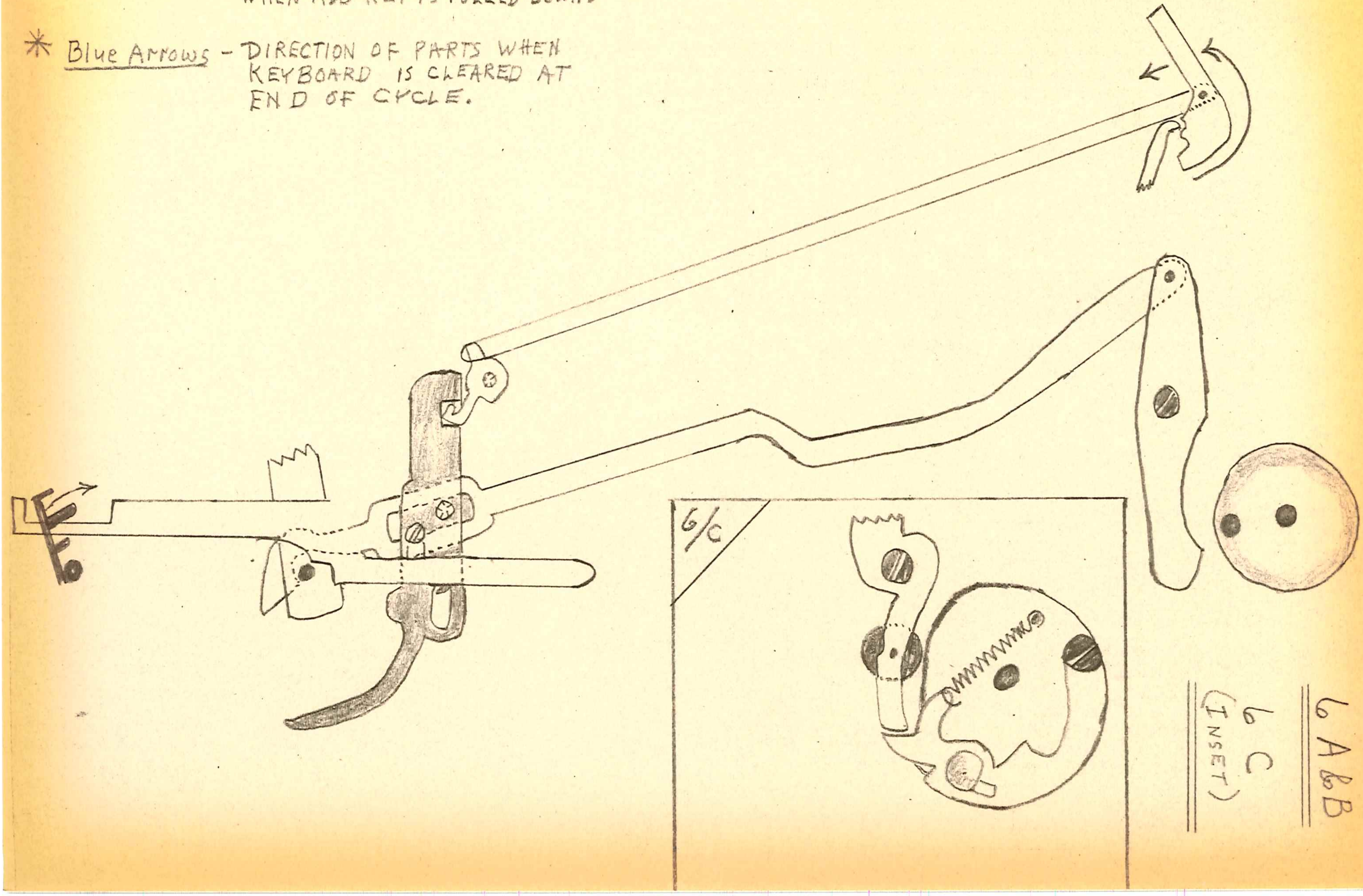
A. Add key moves forward, Bell crank "A" and pittman lever "B" move down. Add Release lever moves forward positioning hook "C" over stud "D" positioning lever "E" so as it may be actuated by stud on Counter Oscilator Cane "F".

B. Stud on Counter Oscilator Cane engages lever "E" moving the bottom forward and the top rearward. This moves Add realease lever rearward and stud "D" moved rearward by hook "C" pulls keyboard clear lever "G", engaged to keyboard clear gate, rearward and keyboard is clear.

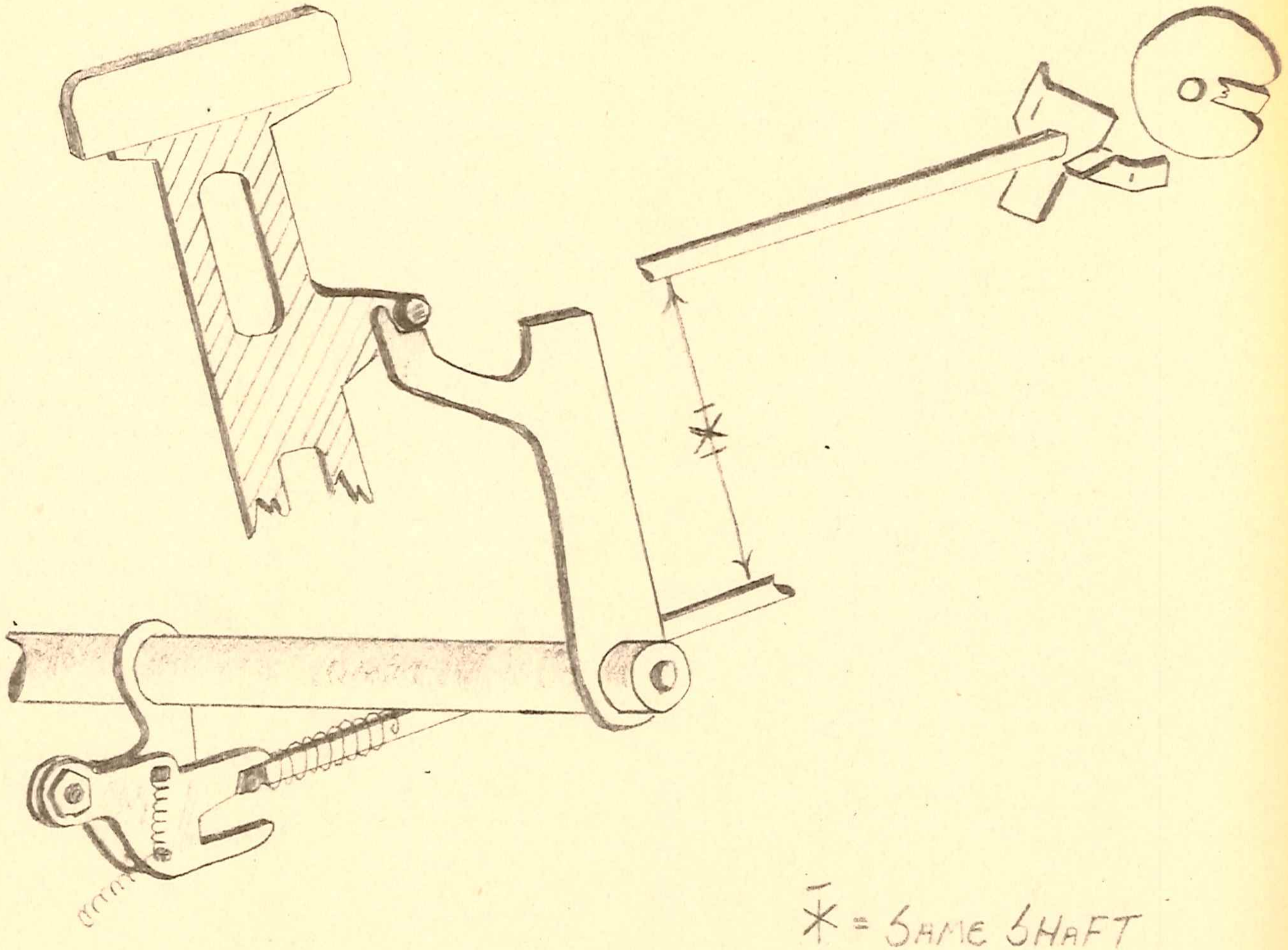
C. As clutch "A" rotates, wheel "B" rolling on cam surface "F" drops into valley "D" allowing clutch release dog "C"to engage clutch Dog "E" thus stopping rotation of the drive shaft.

* Red Arrows - PARTS POSITIONED & ACTUATED
WHEN ADD KEY IS PULLED DOWN.

* Blue Arrows - DIRECTION OF PARTS WHEN
KEYBOARD IS CLEARED AT
END OF CYCLE.



When right shift key is depressed, a stud on the stem cams right shift lever forward, rotating shaft forward and rearward. Shift engaging linkage actuates shift rod rearward and shift clutch controller, on rear end of shift rod, is actuated. Extension "B" on Controller engages tooth "A" which is on the end of Actuator shaft #1 and moves it into slot "C" of shift driver thus engaging Actuator shaft #1 to right shift driver in preparation to shift rigat.

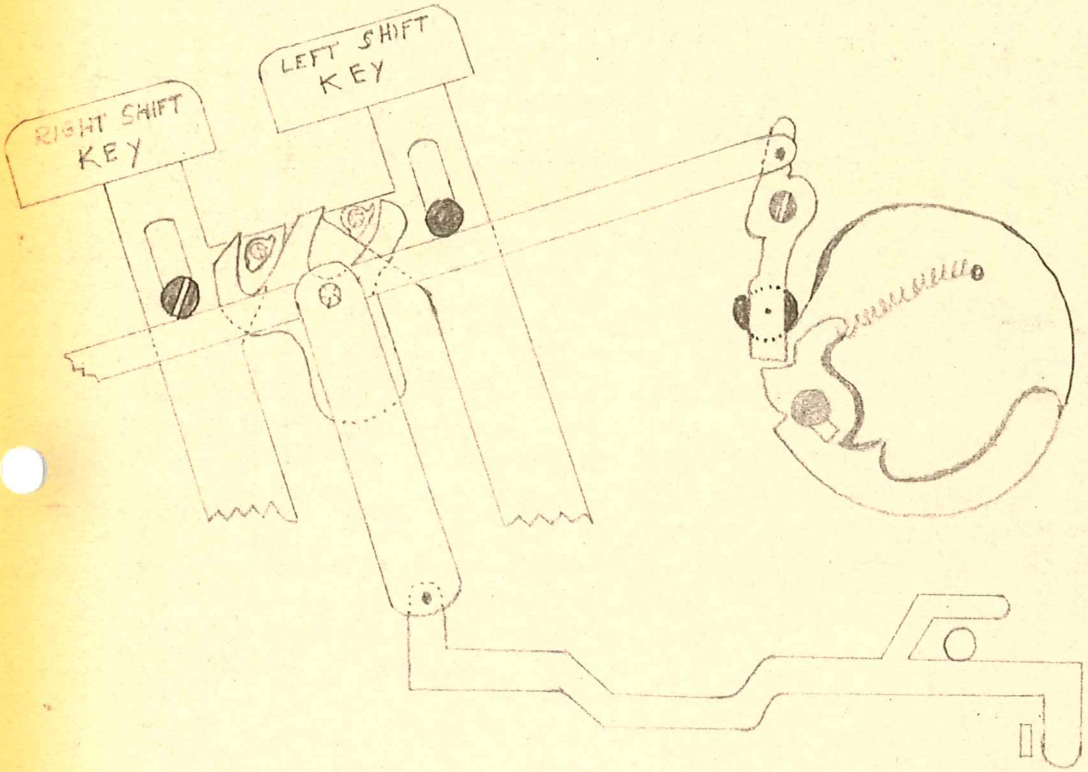


* = SAME SHAFT

Depress either shift key. On each shift key stem is a stud "A", this stud contacts cam surface on Crow foot "B" comming it rearward. Attched to the Crow's foot Assy. is the clutch Release latch, this also moves rearward, pushing top of clutch release Dog rearward. Clutch Release Dog pivats on shoulder screw, thus the bottom of dog moves forward out of mesh with clutch dog, thus releasing dog and clutch.

The bottom of Crow's foot Assy. moves forward pulling switch Control lever Assy forward, closing switch.

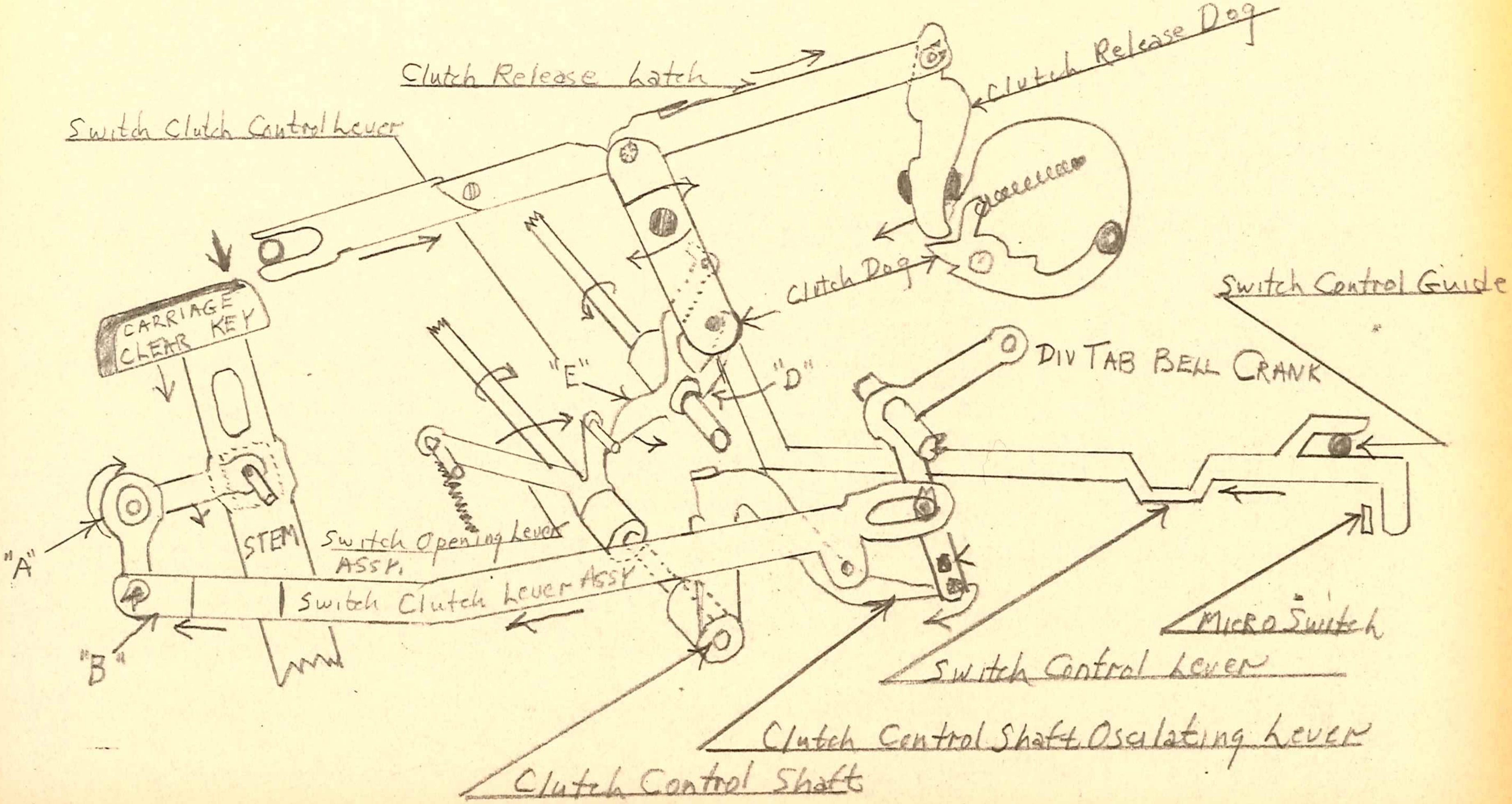
8-A


LEFT SHIFT
KEY
RIGHT SHIFT
KEY

Depress Carriage Clear Key. Bell crank "A" rotates rearward pulling link "B" rearward, link actuates Div. tab. Bell crank and stud on bell crank engages surface "C" of clutch Control lever moving it down and rearward. This lever being pinned to clutch control shaft rotates the shaft rearward and stud on switch opening lever contacts surface "E" of switch and clutch control lever moving it down and rearward, this lever rotates Auto. clear levers shaft forward. Extension "D" of switch and clutch control lever contacts stud on Crow's foot Assy. actuating the bottom forward pulling switch control lever forward thus closing switch. The top of Crows foot Assy moves rearward actuating clutch release latch thus releasing clutch release dog from clutch dog and opening clutch.

"Sequence Of Parts For Carriage Clear Key"

(Release Of Clutch & Closing Of Switch)

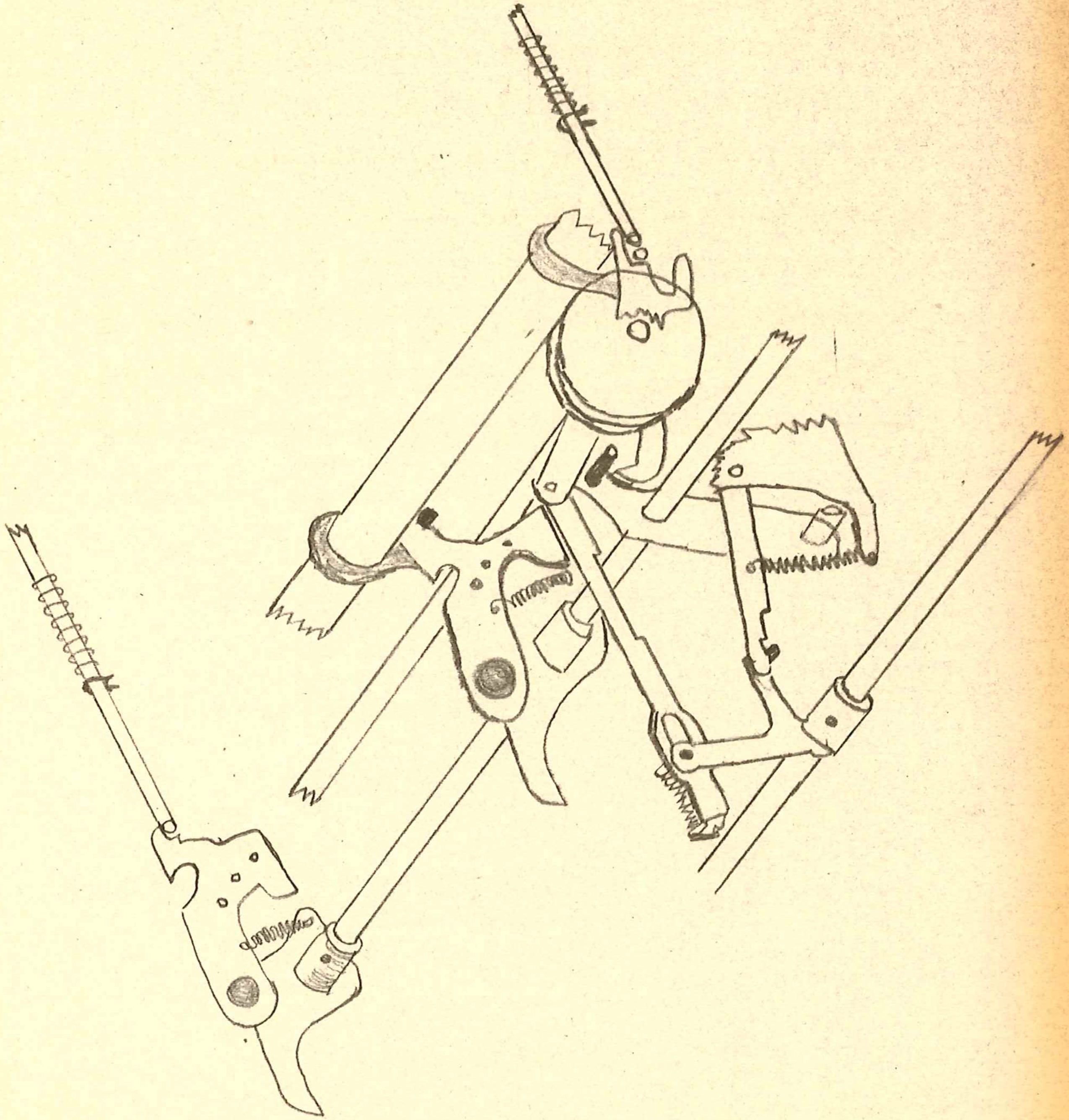

Clutch Release Latch
Clutch Release Dog
Switch Clutch Control Lever
Clutch Dog
Switch Control Guide
CARRIAGE CLEAR KEY
"E"
"D"
DIV TAB BELL CRANK
"A"
STEM
Switch Opening Lever ASSY.
Switch Clutch Lever ASSY
"B"
MICRO SWITCH
Switch Control Lever
Clutch Control Shaft Oscalating Lever
Clutch Control Shaft

9 B & C

B. Depress Carriage clear Key. Clutch control shaft "A" rotates rearward moving shift Actuating Control link "B" to the rear moving hook on Shift latch Reset Eccentric "C" to come in Contact with stud on rear extension of Shift Shaft Oscilator lever "D".

C. Shift Power Shaft rotates turning Shift latch Reset Eccentric "C". Hook on "C" engages stud on "D" pulling down and rotating auto clear levers shaft actuating return clear shift engaging levers "E" & "F" rearward. "E" contacting Auto. clear push rod "G" forcing it rearward, "F" moving left shift push rod "J" rearward through "U" linkage "H" thus power setting your push rods.

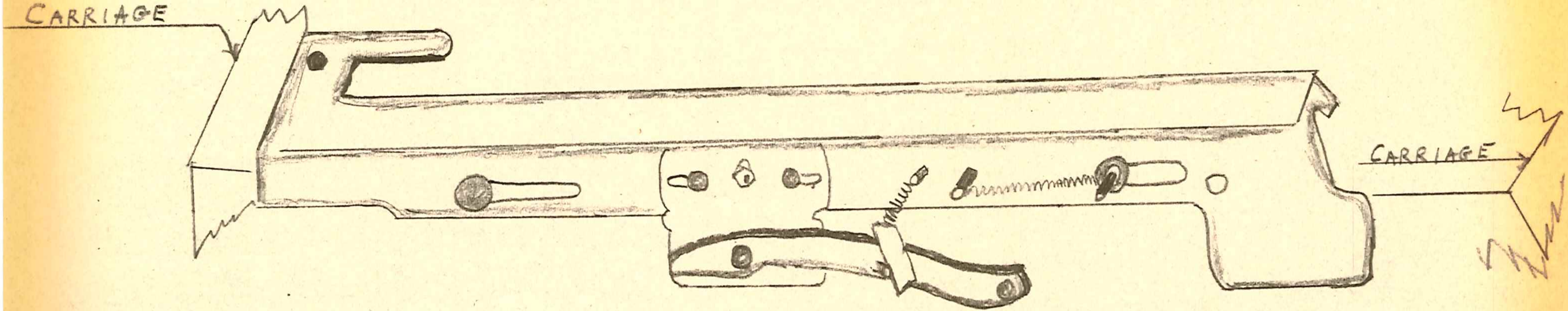
9-B-C-D - PRESETTING & POWER SETTING OF PUSH RODS.

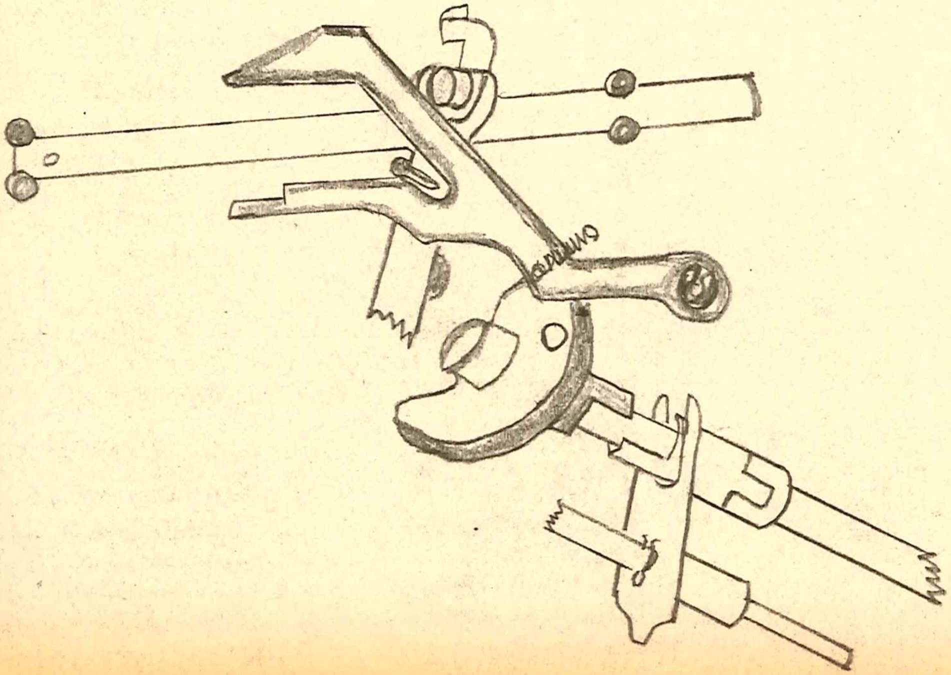


9 D & E

d. After push rods are actuated into position they are held into position by the stud "A" on the shift shaft oscilator lever rearward and stud "B" on bottom end of shift shaft Oscilator lever. Shift shaft Oscillating lever latch hold against stud "B" holding push rods rearward.

e. When Carriage clear key is depressed Auto clear push rod moves to the rear closing Auto. clear clutch which is on rear of #5 Actuator shaft. When clutch closes and #5 Actuator shaft rotates it in turn rotates. Kidney Cam on extreme end of #5 shaft. The Cam Actuates the Auto Clear Cam lever which is engaged with stud on Clear slide. The lever moves the slide to the right of machine, the slide contacts auto clear powl and moves entire clear slide assembly to the right and the counter & Accumulator clear racks dials to Zero.


CARRIAGE
CARRIAGE



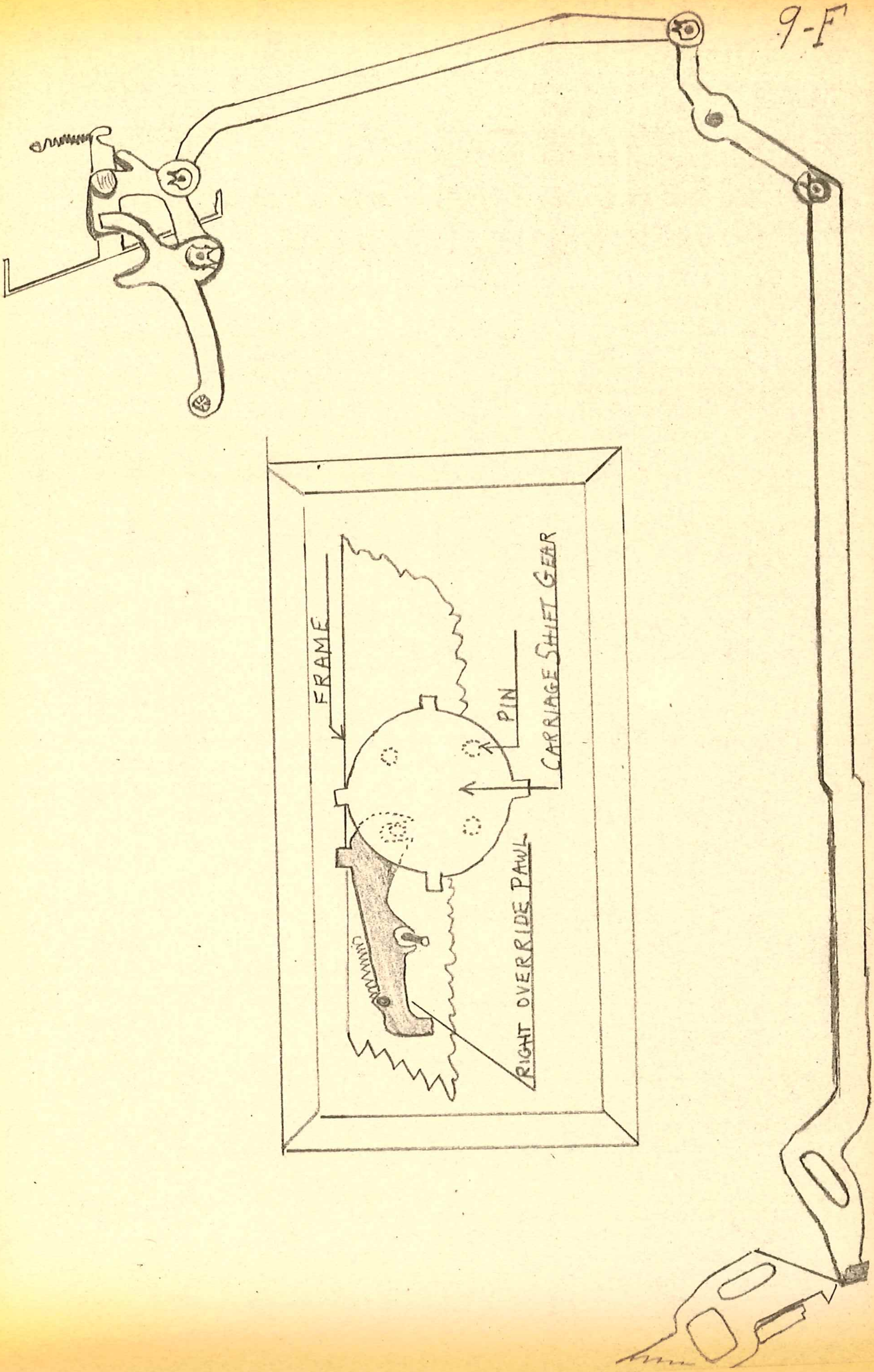
DEPRESSION OF CARRIAGE CLEAR KEY - SEQUENCE OF PARTS CLEARING ACCUMULATOR & COUNTER DIALS.

9 F & G

F. Carriage clear key is released when pin on Shift gear contacts Overside Pawl moving tip "A" down to contact lever "B" moving it down against shift set-up lever latch ASSY. at point "C". This moves linkage "D" down and forward disengaging tip "E" from notch "F" in carriage clear key, thus releasing key.

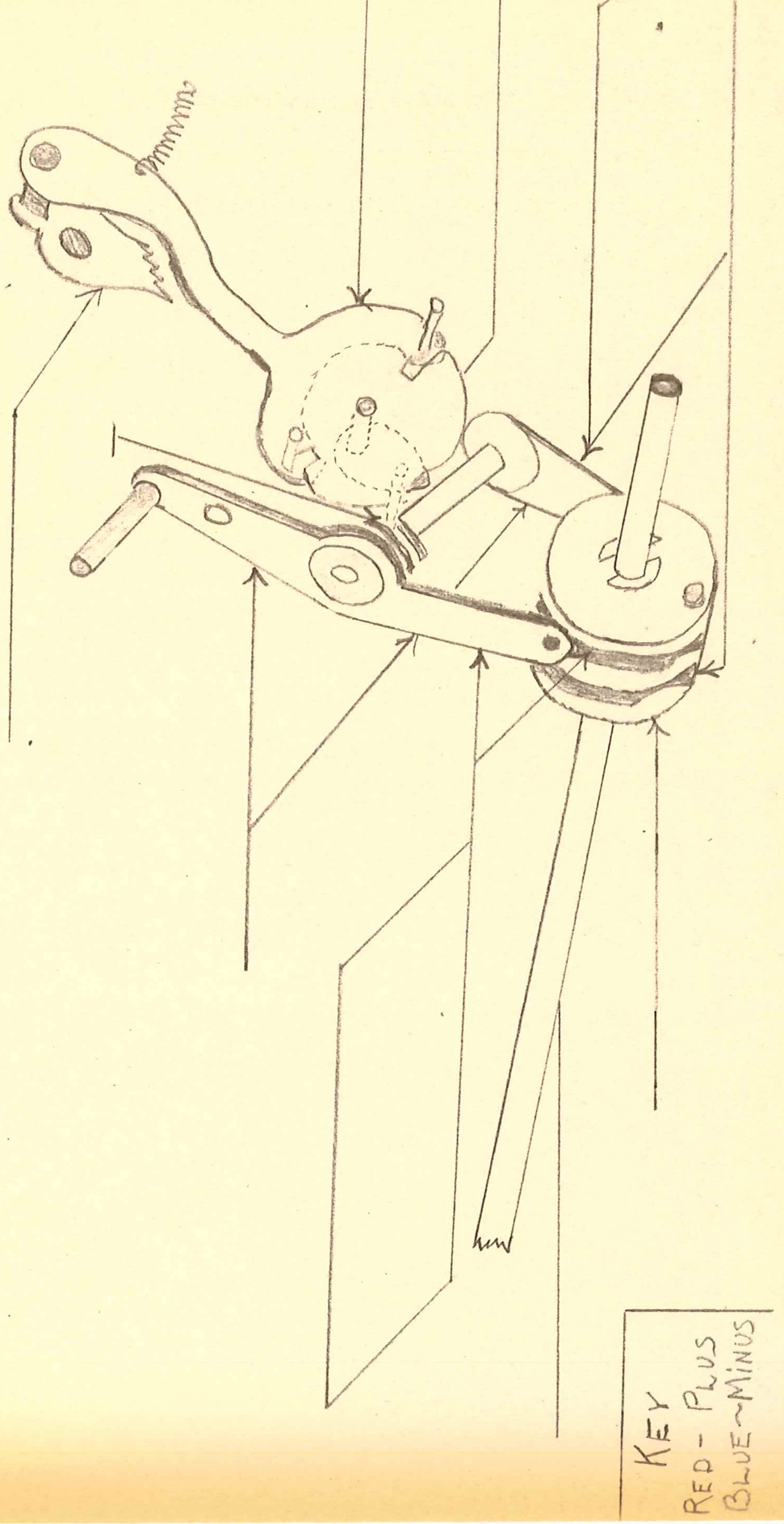
G. Reverse action of clutch control shafr mves eccentric on shift Actuating control lever up to contact #71344 to delatch it from stud on shift shaft Oscilating lever.

*(See drawing for 9 B, C. & D)


FRAME
PIN
CARRIAGE SHIFT GEAR
RIGHT OVERRIDE PAWL

Depress Plus Key(red arrow). Division Control slide moves to rear moving Counter Reverse lever also to rear. This action rotates Counter Reverse Can to the rear moving stud "B" riding in groove of Wobler, and Wobbler upward bringing lower arm of Wobbler in mesh with left hand groove on bottom of Oscillator Cam. Minus Key actuation is opposite, follow blue arrows.

10-A

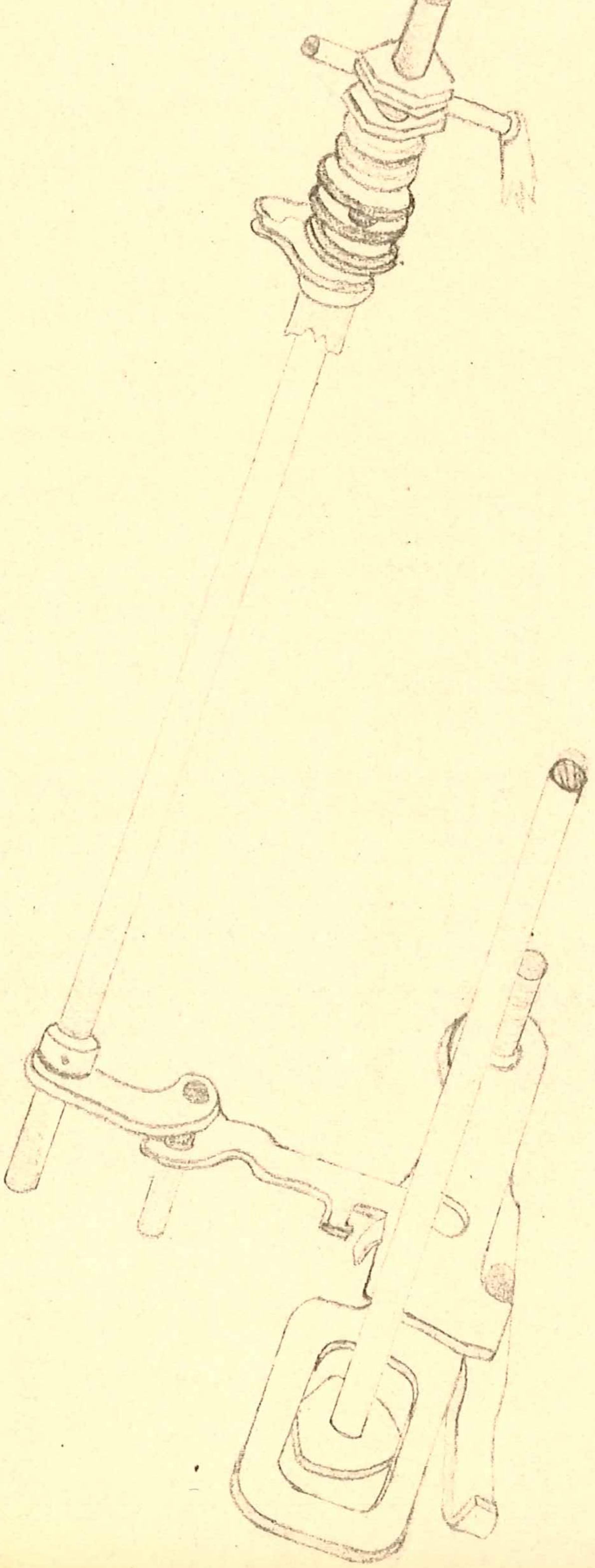

KEY
RED - PLUS
BLUE ~ MINUS

10 B &

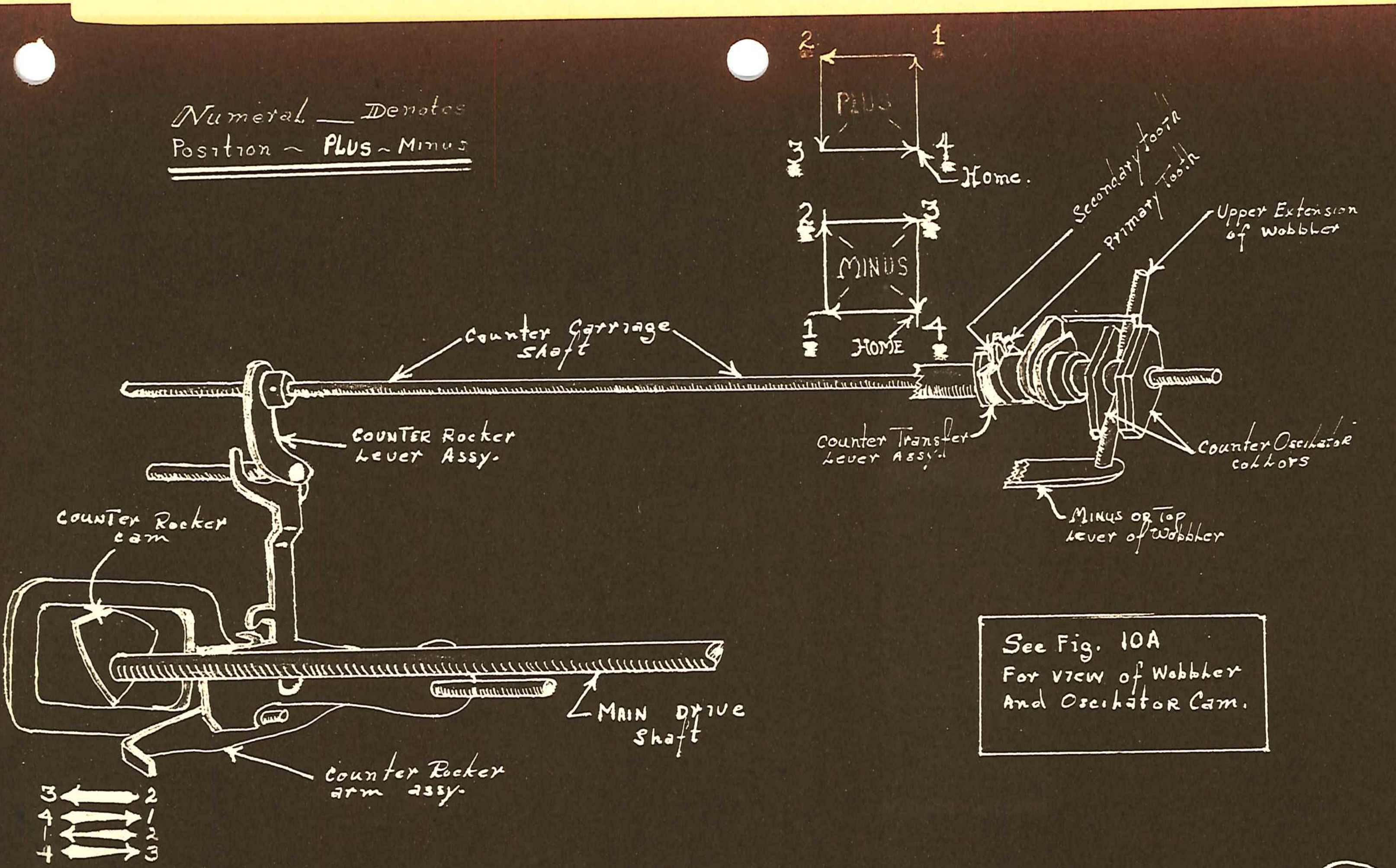
Plus operation- Counter moves to rear by action of Counter Racher Cam & arm coming in mesh with dial, then moving to the left moving dial and them to the front out of mesh and then action from Counter Ascilator Cam and Wobbler moves to right to home position.

Minus operation- Counter moves to left then to rear coming in mesh with dial then moving to right turning dial and then to the front out of mesh and to home position.

10-B



Numeral — Denotes
Position ~ **PLUS** ~ Minus



2
1
PLUS
3
4
Home.
2
3
MINUS
1
HOME
4
Secondary tooth
Primary tooth
Upper Extension of Wobbler
Counter Carriage Shaft
COUNTER Rocker Lever Assy.
Counter Transfer Lever Assy.
Counter Oscilator collars
Minus or Top Lever of Wobbler
COUNTER Rocker cam
MAIN Drive Shaft
Counter Rocker arm assy.
3 2
4 1
1 2
4 3

See Fig. 10A
For view of Wobbler
And Oscilator Cam.

BLUE—MINUS
RED—PLUS

Wobbler Movement ~ Sideways
Rocker Assy. Movement ~ Front to Rear

(10~B)

DIVISION

11. The following is Division pre-setting only. Division Aligner Parts not included. To delatch the Division mechanism, rotate Crank so Carriage shifts to Right a place or two and push up on Division Stop Lever. Where the answer is partly the same as the previous, do not rewrite, just write in the different action.

(a) Operate Left,(Inside) Division Starting Lever only. Trace sequence of parts that actuate Clutch Release Dog from Clutch Dog. (Pg. 71, Light Blue Cross Lines; Pg. 55, Dark Blue Lines)

(b) Trace sequence of parts that place Add-Subtract gate into Subtract Position. (Pg. 71, Blue Cross Lines; Pg. 70, Orange; Pg. 68, Red.)

(c) Trace sequence of parts that actuate Shift Actuating Collar A-bly (Shift Engaging Lever) to Left. (Pg. 71, Blue Cross Lines; Pg. 70, Brown; Pg. 56, Blue, Pg. 67, Blue.)

(d) Trace sequence of parts that position Connector Arm. (Pg. 71, Blue Cross Lines; Pg. 70, Brown; Pg. 67, Black)

12. Plug in Cord. Depress Division Key and Hold Down. Notice Clutch Release Dog is released but machine does not operate. Trace how Clutch Dog in Clutch Assembly is held till Division Key is released. (Pg. 70, 55, Violet)

13. (a) Depress Outside Division Key only. Trace sequence of parts that raise Counter Reverse Lever (Pg. 69, Green) to allow "Wobbler" to be placed in position for positive count in Counter Dials in Division. (Pg. 69, Violet; Pg. 71, Violet, Green)

(b) Observe on depression of Inside Key only the difference in action of "Wobbler".

14. The following is for the actual Division Operation only, therefore, please follow instructions to eliminate the Division Aligner operation.

Place carriage in 6th position - Dials Clear. Place $625.00 in Keyboard. Plus this in Accumulator Dials. Clear "1" from Counter Dial. Clear the Keyboard. Place $25 in Keyboard. Depress Division Keys and Release them. Rotate Hand Crank. Now observe that Carriage Shifts to the Right automatically as machine operates. This is the Aligning operation. Continue to rotate Crank until the Carriage Reverses direction and shifts one space back to the Left which places the "25" in Keyboard under the "62" in the Upper Dials. From this position the Machine is in Regular Division and the answer to (a) and (b) starts from this position.

Observe as you continue to rotate the Crank the "625" is divided by the "25". Observe the overdraft (that is, the Dials turning to 9's). Observe the "9's" are restored - observe the Carriage Shifts then the "25" is subtracted from the "125" in the Dials. (To start this operation again, start at beginning per above instructions.)

(a) When does the overdraft occur and what is the mechanical action to make it occur?

(b) Go through the following first then write answer in the proper order of continuous action. Trace out sequence of parts actuated by overdraft. (Pg. 77, Orange; Pg. 68, Orange and Purple; Pg. 67, Orange)

Trace sequence of parts that are actuated to Move Add-Subtract Gate from the Subtract position to the Add position for the Restore Stroke. (Pg. 68, Light Green Cross Lines; Pg. 67, 69, Light Green; Pg. 70, Purple; Pg. 68, Red)

Trace sequence of parts that cause and allow the Add and Subtract Gate to Centralize from the Add Position and how it is held centralized (Pg. 69, Light Green; Pg. 67, Violet; Pg. 70, Black) and how the Carriage is shifted. (Pg. 67, 73, Yellow; 68, Black; 72, Yellow)

Trace sequence of parts that place the Add and Subtract Gate from the Centralized Position to the Subtract Position. (Pg. 69, Light Green; 67, Brown; Pg. 70, Purple; 68, Red)

15. (a) What part Latches the Division Control Levers and holds them in Division? (Not Division aligning operation)

(b) What is the sequence of action and the parts involved to delatch the Division Control Lever, when the Carriage reaches First Position in Division, so machine will stop. (Motion and position of Division Control Lever important.) (Pg. 76, Orange; Pg. 55, Purple Cross Lines)

(c) With the machine in a Division operation, how is the Division Control Lever delatched when the Division Stop Lever is pulled to the front of the machine? (Motion and position of Division Control Lever important.) (Pg. 57, Blue Cross Lines)

(d) How is the Division Control Lever delatched when the Division Stop Lever is pushed to the rear?

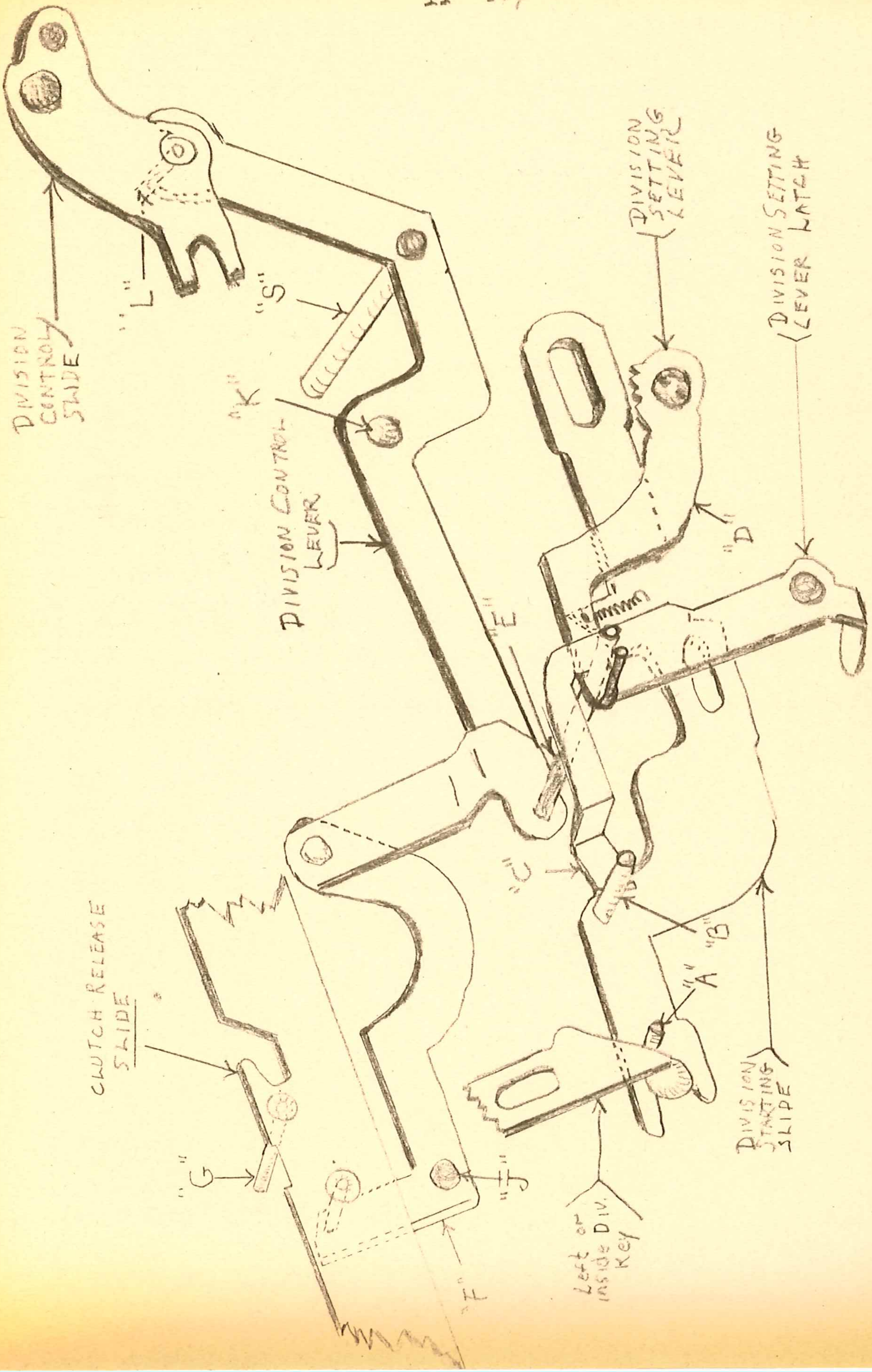
Study over again and again these questions and answers. You will be asked how these operations work. You must know how the machine operates to properly service it. Just because you have completed these questions do not forget them.

11 A & B

A Depress inside Div. key. Cam surface on key stem cams. Division starting slide to rear when contacting "A". Stud "B" contacts lever "C" moving it to rear unlatching stud on lever "D" releasing lever "D"allowing it to come down under spring tension to contact stud "E" (Blue) moving it down. This stud is at central pivat point of Division Control lever and moves it down. Upper extention "F" pivating at "J" moves rearward against stud on clutch release clutch. Stud "G" is engaged in clutch release latch moving it with C.R. slide

B Rearward from stud "E" lever pivats at "K" moving cam surface "H" upward to contact stud "L" camming it forward into notch of lever, thus moving Division Control slide forward into subtract position.

11~A&B

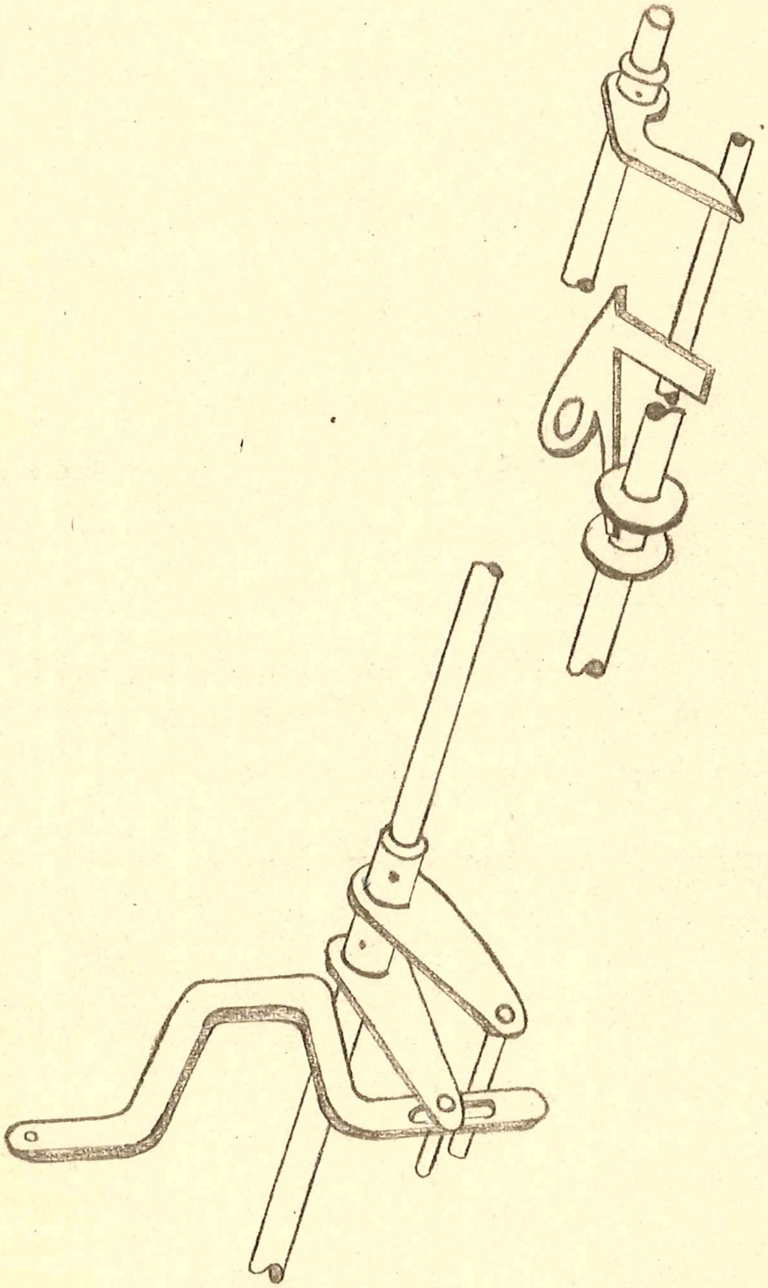

DIVISION CONTROL SLIDE
"L"
"S"
"K"
DIVISION CONTROL LEVER
"E"
DIVISION SETTING LEVER
DIVISION SETTING LEVER LATCH
"D"
"C"
"B"
"A"
DIVISION STARTING SLIDE
Left or inside Div. Key
"F"
"J"
"G"
CLUTCH RELEASE SLIDE

11 C & D

C. When Division is depressed stud "S" on Division Control lever engages extension "A" of Bell Crank for Div. Shift Shaft moving it forward, extension "B" riding in cellar "C" moves to left of machine thus moving shaft to engage shift. Point "D" is where Bell crank pivots.

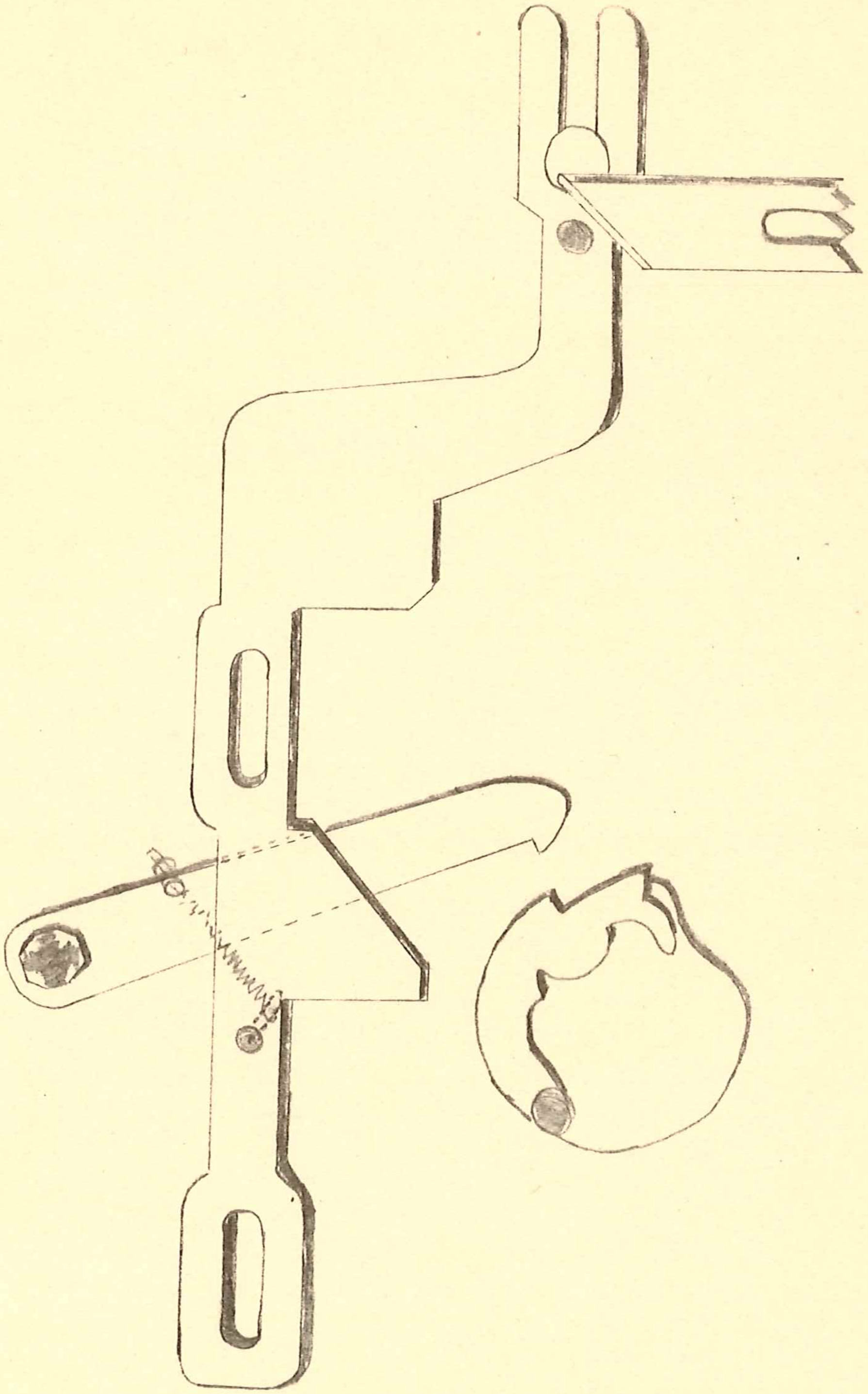
D. Stud "S" on Division Control lever contacts Bell crank lifter Pawl almost simultaneously as it contacts Bell Crank for Div Shift Shaft as it contacts Pawl it moves it forward rotating Lifter shaft rearward, this actuates Counter Blockout Disabling Arm and lifter arm pinned to shaft, thus actuating connector arm upward (and forward) positioning it against toil of flag.

11-C&D

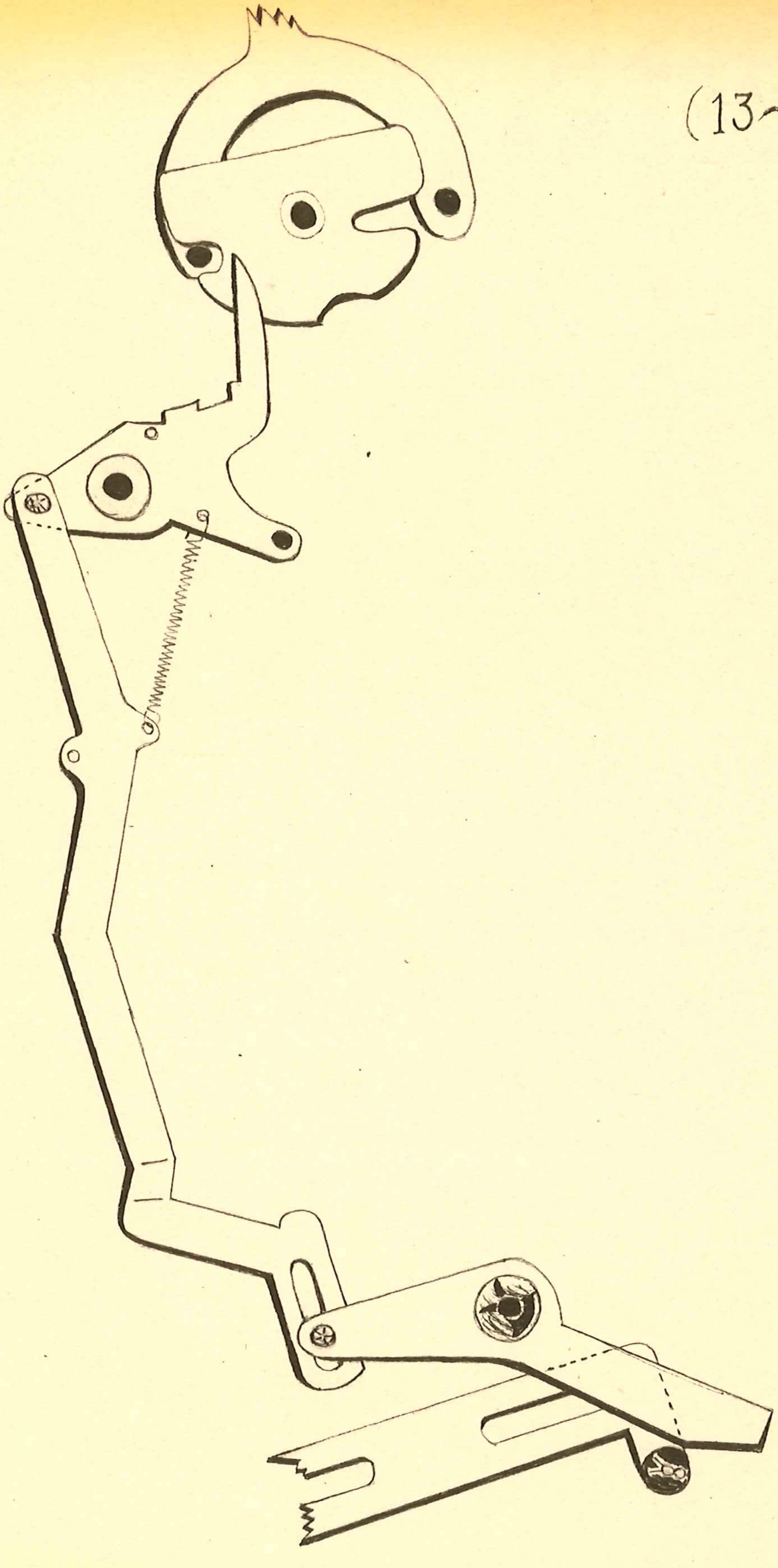


12. –Upon depression of Division Kwy cam surface "A" contacts stud "B" moving Division starting slide to the rear. Under tension of actuating spring "C" the clutch. Holding Pawl is moved rearward also. Tip "D" of clutch holding Pawl engages clutch Dog at "E" thus preventing clutch from opening until Division Key is released.

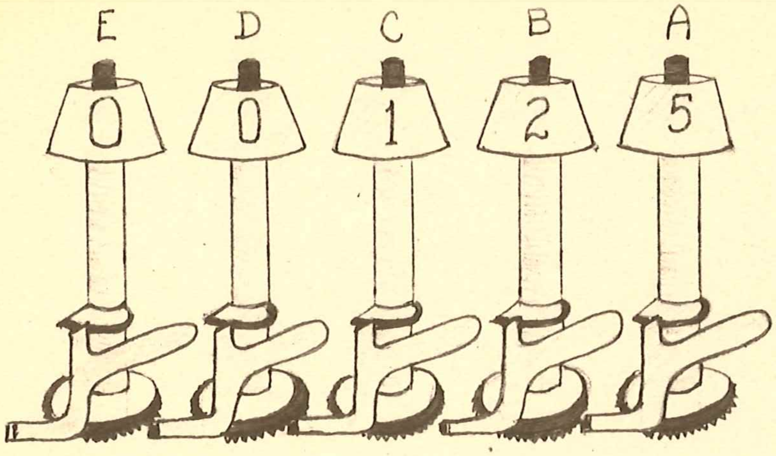
13 – Upon depression of outside division Key. Roller "A" on Key stem contacts True Quotient bell crank and moves it rearward, it pivats at "B" moving top forward actuating lever assy. forward, Lever "C" pivating at "D" moves tip "E" upward engaging stud "F" on Counter Reverse lever shifting it out of notch, thus pulling stud "G" into lower notch of Counter Reverse Can. so as Wobbler is positioned for positive count in counter dials.

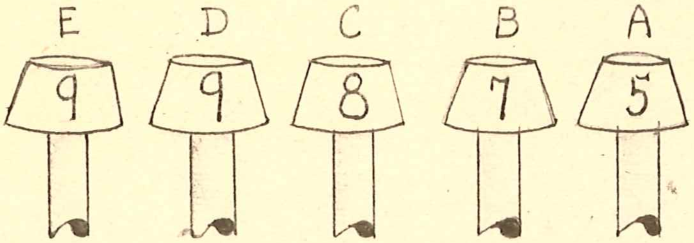


(13~A)



The overdraft occurs when the 25 on the keyboard is subtracted from the 12 on the dials. 25 has been subtracted twice from the 62 leaving 12. On the third subtraction 2 minus 5 produces 7 on dial "B" and actuates transfer lever for transfer on dial "C". On dial "C" 1 minus 2 (from the keyboard) munus 1 carried by transfer from dial "B" produces 8 on dial "C" and actuates transfer lever for dial "D". As the Add-Subtract gate is in Subtract position as transfer will produce a 9 actuating the trahsfer lever for next column continuing across Accumulator dials.


E
D
C
B
A
0
0
1
2
5


E
D
C
B
A
9
9
8
7
5

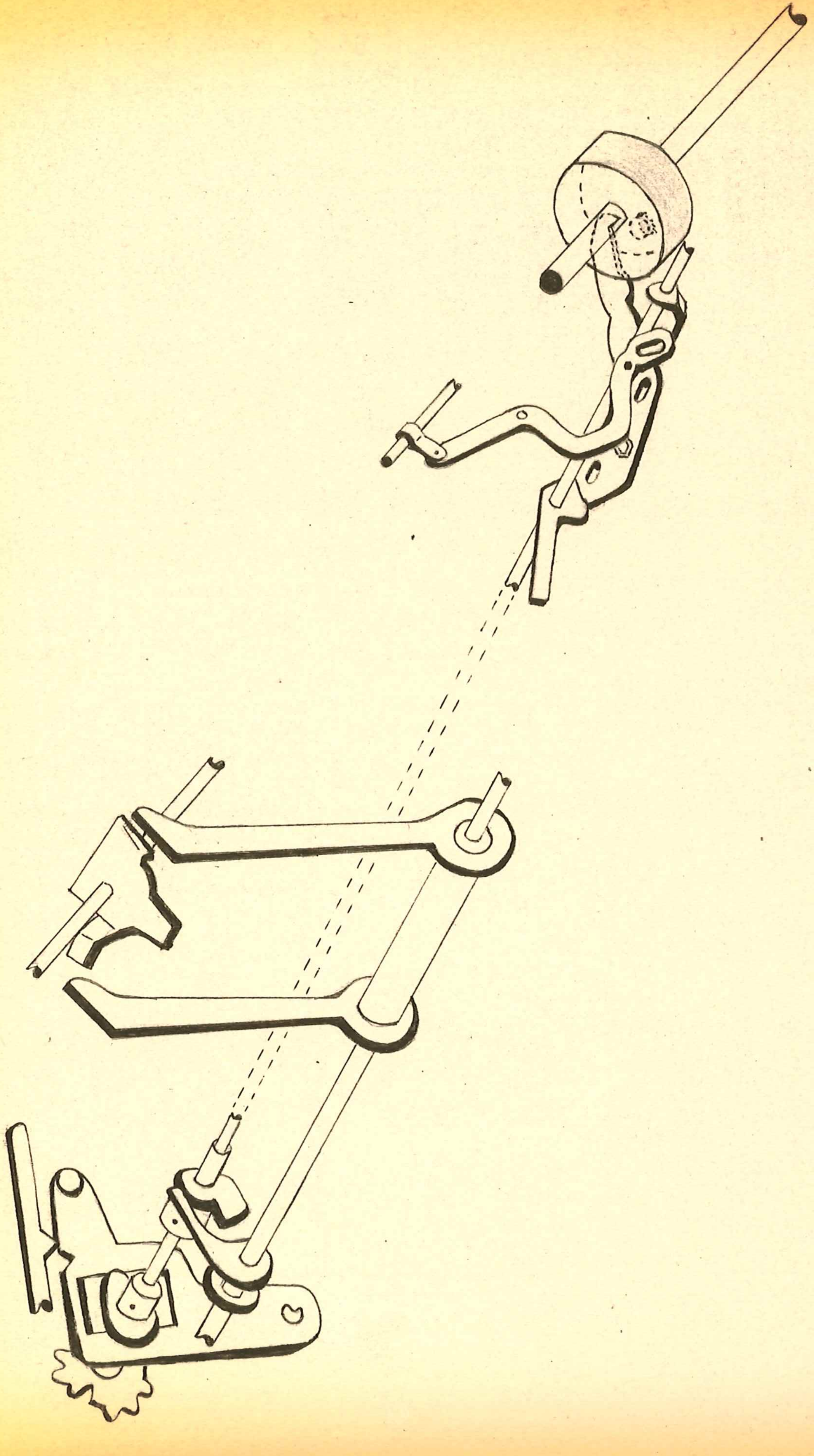
1. Overdraft actuated all transfer pins and gears to #10 (8 bank) #12 (10 Bank). This is the long transfer pin "A" and at this point "A" actuates connector Arm and it engages tail of Flag at point "B" moving it down bringing extension "D" in position to be actuated by stud "C" on roller on #6 actuator shaft. When "D" is actuated it moves Division throwout shaft and Assy. to the right positiong Division Control Cam on Division Control Arm and moves Div Control Gear out disingaging pivit on control plate from notch "E" and allowing the first set of 3 teeth to engage with the 2 teeth on the Intermitten Gear. Upon rotation D.C. Cam actuates D.C. Arm rearward to plus position.

2. Division Control Cam continues to rotate moving Div Control Arm forward to a neutral position. This happens when 2nd set of 3 teeeth on Division Control gear engage 2 teeth onIntermittent gear. When Div. Control Arm reaches a meutral position tooth "F" on centralizer engages notch "G" and holds it centralized. At this point., shift throut Cam "H" engage extension "J" of shift throught actuator assy. Cumming it upward rotating shift Actuator shaft rearward moving shift engaging lever "K" to contact left shift controller "L" pusing it rearward so as "M" may engage tip on end of "2 Actuator shaft into the left shift driver in preparation for a left shift.

3. After left shift, the 2 teeth on the Intermittent gear engage the 3rd set of 3 teeth on Div Control Gear rotating Div throwout shaft on which rotates Div Control Cam, Camming Div Control Arm forward from neutral to subtract position. Pin on Control Plate returns in notch "E" of Div Control Gear and shaft returns left where it will remain until next overdraft.

3. After left shift, the 4 teeth on the Intermittent gear engage the 3rd set of 3 teeth on Div Control Gear rotating Div throwout shaft on which rotates Div Control Cam, Camming Div Control Arm forward from neutral to subtract position. Pin on Control Plate returns in notch "E" of Div Control Gear and shaft returns left where it will remain until next overdraft.

(14~B)



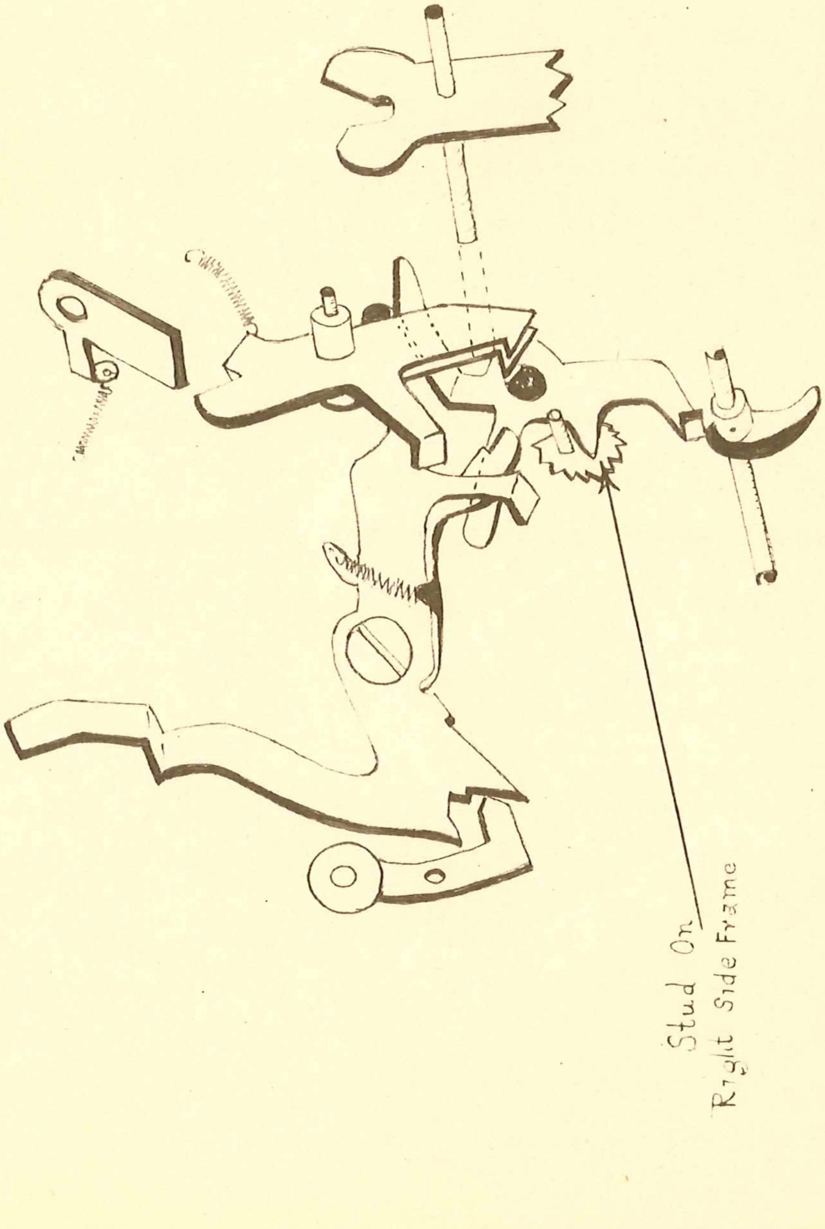
15 A & B , D & C

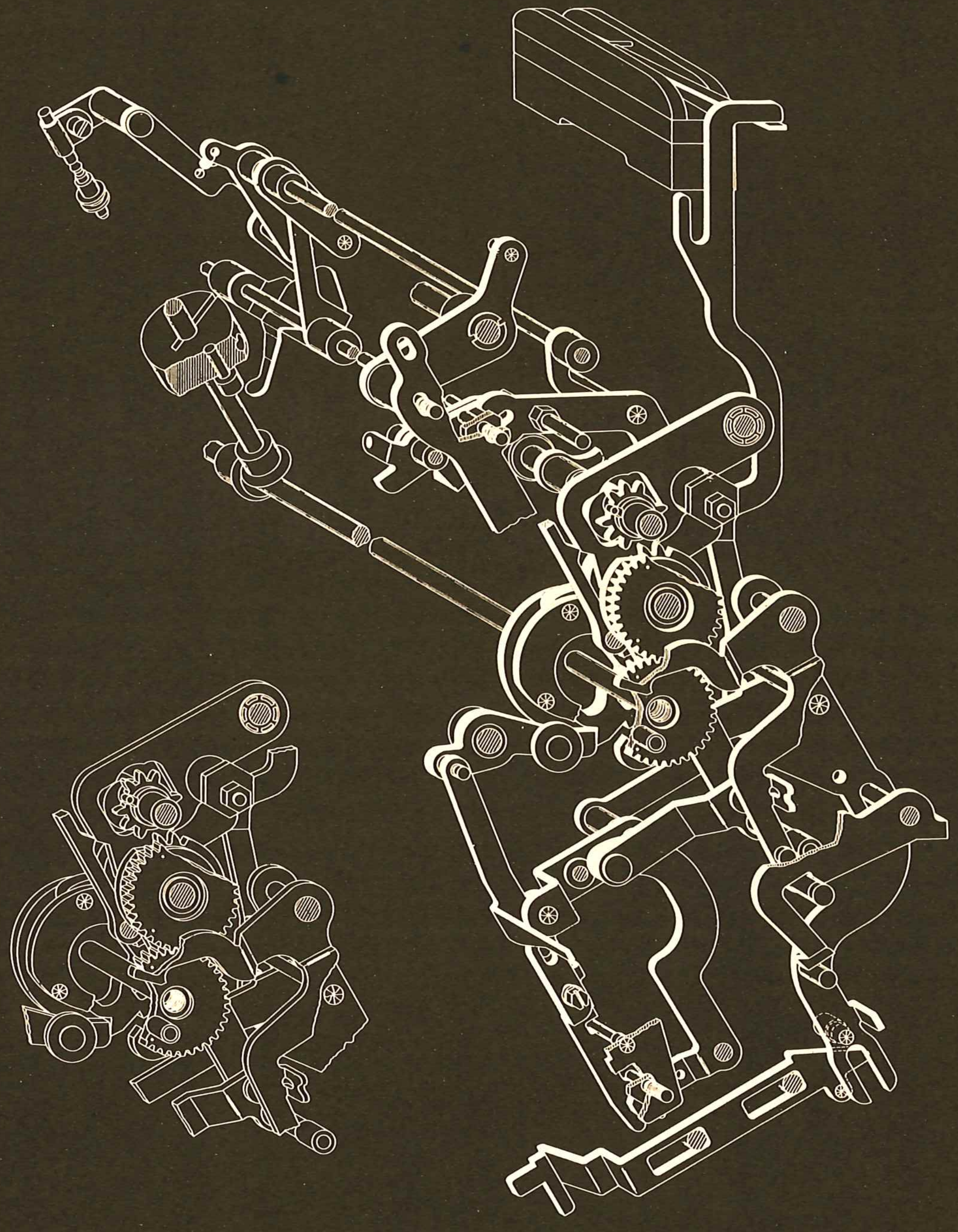
A. Division Control levers ar held in division by Division latch "A" and Auxillary latch "B" upon depression of Dvi Keys. Aux latch "B" holds Div Control levers. On thrid verolution Cam "D" actuates retore lever "E" to delatch aux latch "B" so Div latch "A" cam latch

b. When carriage reaches 1st postion lever "F" held by spring "G" contacts Div latch "A" moving it rearward releasing Div Control levers. When Div lever "C" moves to the front to place Add-Sub Gate in minus position Div Stop "F" position behind Div latch "A" and when "C" moves to rear to neutral position, latch "A" is held out thus ~~t~~stopping Div operation.

c. When Div Stop lever is moved to fron projection "H" moves up when Div Cont lever "C" moves to Add position H moves lever J and E up. The end of J contacting and holding out latch A. When C moves to Sub position bothe A & B are held out releasing C thus stopping machine.

d. When Div stop lever is pushed to rear, extention K of Div stop lever pushed down on extension of latch A thus releasing control levers when they move to sub position.


Stud On
Right Side Frame



-IMC-

DIVISION ALIGNER

Follow this Schedule. Refer to Manual from this Schedule.

The following explanation will only be on the features which compose the Division Aligner. The regular Division operation after the Aligning is the operation which you have traced and is the same in all models. The Aligner is nothing but a feature to position the Carriage to the Right automatically to align the figures in the Accumulator Dials with the figures in the Main Keyboard.

The depression of the Division Keys accomplishes the same results in presetting the parts for a Division operation as in the Standard machine, plus the addition of the presetting of the Division Aligner parts.

AUXILIARY LATCH #21160

On the STW, the Division Control Unit #65090 can be latched with the Carriage in first position with the Division Stop (Orange, Pg. 76) on the Carriage engaged with the Division Latch (Pg. 55, Purple Cross Lines). This latching action is not possible on the Standard machine.

This is accomplished by the Auxiliary Latch (Pg. 57, Red Cross Lines) located adjacent to the Division Latch #21165 and is approximately .018 shorter than the Division Latch. When the Division Control Lever (Orange, Pg. 70) is actuated on the depression of the Division Keys, the Latch Stud latches onto the Auxiliary Latch #21160 first and will remain there until the 40070, Division Control Gear A-bly. has revolved to the third set of teeth on the #40006 Gear (Pg. 67), or at the beginning of placing the Add and Subtract Gate into the Subtract position which brings the Restore Cam (Blue Cross Lines, Pg. 67) 40070 assembly into contact with and actuates the Restore Lever (Red Cross Lines, Pg. 55) to delatch the Auxiliary Latch #21160 from the Latch Stud, thus allowing the stud to drop onto the Division Latch #21165 and remain there until delatched at the end of a Division problem or by use of the Division Stop Lever.

No matter where the Carriage is located, the Latch Stud always latches onto the Auxiliary Latch first.

The sole purpose of the Auxiliary Latch #21160 is to allow the Division Control Unit A-bly and Mechanism to latch with the Carriage in first position with the Division Stop engaged with the Division Latch #31165.

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POSITIONS AND OPERATIONS OF DIVISION ALIGNER PARTS

Place #1 in first Keyboard Column; Accumulator Dials Clear; Carriage in first position. Looking at machine from rear -- Division Shift Actuator #41120 Pg. 67 (Red) will be in home position with:

Right Shift Arm to Right of ear on Shift Clutch Controller.
Left Shift Arm with full bite to ear of Shift Clutch Controller.

DIVISION ALIGNER (CONTINUED)

When the Division Keys are depressed, the long stud on Division Control Lever actuates Bell Crank #40066 (Pg. 56, Blue), upper end of which fits into Division Shift Throwout Actuator A-bly #40045 (Pg. 67, Green Cross Lines), thus actuating the Shaft, which has on the left end the bracket for securing the two Latches; the Division Latch (Inside Latch), Pg. 67, Red Check Mark, and the Sensing Latch (Outside Latch), Pg. 67, Blue Check Mark.

The two Latches are latched onto the Left Shift Arm, thus pulling #41120 A-bly to the left and bringing the Right and Left Shift Arms to the left, so Right will be in contact with ear of Right Shift Clutch Controller and Left will clear.

Attached to bottom of Left Shift Arm is Lever #41107, Pg. 67 (Orange Cross Lines). When #41120 is actuated to the Left, Lever #41107 moves to the left and cams the tail of Flag #41178 so upper end of Flag #41107 will be cammed into place for the Roller on Division Throwout Cam of #6 actuator to contact it, thus actuating the Division Control Shaft #41176 and 40070 into mesh with the Division Idler Gear. (Pg. 29, Par. 86)

Also when the long stud on Division Control Lever is raised it actuates the Bell Crank Lifter Pawl A-bly #40030, Pg. 67 (Black) on right end of Bell Crank Lifter Shaft, rotating the Shaft so the Lever #41155 (Violet Cross Lines), left end of Shaft is moved in and upward allowing the Stud on #41155 to contact and actuate Lever #41150, Pg. 58 (Red), thus stretching #1102 spring and adding tension on Lever #41140 (Brown).
#41140 cannot move because the rear end is contacting the round side of the Cam, #41177, Pg. 58 (Violet)

****

The above so far has been the presetting of the Division Aligner parts, now for some of the actions of the parts.

Rotate the Hand Crank and observe an overdraft occurs all the way to the Long Transfer Pin which, when actuated, actuates the Connector Arm, and the Stud, left side midway of the Connector Arm actuates the Connector Arm Bail #41128 (Inside Bail) Pg. 67, (Purple), thus detaching the Inside Latch #41114 (Red Check Mark) from the Left Shift Arm. While #41114 Latch is delatched, the Outside Latch #41113 (Blue Check Mark) is holding the #41120 in place.

At the time the Long Transfer Pin is actuated, the 40070 moves out into mesh, thus causing the Add and Subtract Gate to move from the Minus position to the Add or Restore position during which time the Inside Latch is engaged again on the Left Shift Arm. (This action of the Connector Arm has nothing to do with the positioning of the Division Control Gear A-bly in the Aligning operation.)

When the Restore Cycle occurs there is another transfering action to the position of the Long Transfer Pin which again causes the Connector Arm, the Inside Bail #41128 and Inside Latch #41114 to actuate.

DIVISION ALIGNER (CONTINUED)

As the Shift Cycle occurs the Inside Latch #41114 will again relatch and as the Carriage shifts to the Right the Detecting Lever #41148, Pg. 58 (Dark Blue) slides off the Dummy Sensing Finger #91526, Pg. 77 (Red) on Front Carriage Rail and moves inward against Sensing Finger #91527 (Red Cross Lines). This action of the Detecting Lever #41148 is caused by the #1102 Spring tension on Lever #41140, Pg. 58. Lever #41140 is able to move because the flat side of Cam #41177 has moved around thus allowing #41140, to actuate Detecting Lever #41145 (Green) and #41148 (Dark Blue). The lower part of #41140 is linked by #41138 (Pg. 58, Yellow) to Outside Bail #41135 (Blue Cross Lines) Pg. 58-67, thus the action of #41140 will cause the Outside Latch #41113 (Blue Check Mark) to delatch from Left Shift Arm.

When the Outside Latch #41113 has delatched from Left Shift Arm the Division Shift Actuator #41120 moves to the right slightly and stops because of Inside Latch #41114 holding Left Shift Arm.

The Outside Latch #41113 is approximately .018 shorter than the Inside Latch #41114. This allows the action of the Inside Latch #41114 to delatch and relatch onto Left Shift Arm as long as the Outside Latch #41113 is latched, also the difference in length allows the #41120 to move to the right slightly and stop against #41114 when the Outside Latch is delatched.

When the #41120 is against the Inside Latch #41114 the Shift Arms are located as follows in the Shift position:

Left Shift Arm clears ear of Left Shift Clutch Controller .005-.010.

Right Shift Arm approximately 50% minimum bite to right of ear on Right Shift Clutch Controller.

On the next over draft the Inside Latch will be delatched from the Left Shift Arm and the #41120 will move to the right and align the Shift Arms as such in Shift operation.

Left Shift Arm with 100% bite to Left Shift Clutch Controller ear.

Right Shift Arm clears right of ear on Right Shift Clutch Controller. (#41120 will be in Normal position again.)

When both latches #41113 and #41114 are delatched from #41120, the machine will have completed the Aligning operation and then will go into the regular division operation.

****

So far the action of the Division Aligner has been observed with the Accumulator Dials clear, which shows the position of the Division Shift Actuator #41120, ahd the action of the Latches #41113 and #41114.

Place #1 in first keybaord column. Carriage First Position.
Place #4 in fourth Accumulator Dial. Looking at machine from the rear, depress Division Keys, operate by Hand Crank.

DIVISION ALIGNER (CONTINUED)

The first revolution will cause an overdraft or transfer in the Accumulator Dials, but notice this action does not continue past the figure 4 in the Accumulator Dial.

On the next revolution of the machine, notice the Add and Subtract Gate moves from the Subtract position to the Add or Restore position. This is caused by the 40070 being moved out and into mesh with the Division Idler Gear. The action of the #40070 coming out was accomplished by the Lever #41107 camming the Flag #41179 into contact with the Roller on Cam of #6 Actuator.

NOTICE the Inside Latch #41114 did not delatch from Left Shift Arm on the first revolution for the fact of not transfering past the #4 in the Accumulator Dial.

Notice when the Shift Cycle is made the Detecting Lever #41148 will move in and allow the Outside Latch #41113 to delatch from Left Shift Arm. This action is the same as in the preceding section.

When the Outside Latch #41113 delatches, the #41120 will move to the Right and Stop because of the Inside Latch #41114 contacting Left Shift Arm.

The next cycle with the Add and Subtract Gate in the Subtract position will again cause a transfer to the figure in the Accumulator Dial but not past this Dial, and the continuing cycles will give the Restore Cycle, RIGHT Shift Cycle and Overdraft Cycle until the Carriage has shifted or aligned itself so the figure 4 in the fourth Accumulator Dial will be past the #1 in the Keyboard.

When the Add and Subtract Gate moves into the Subtract position after the last Right Shift Cycle, which placed the #4 in Accumulator Dial to the RIGHT of the #1 in the Keyboard, and the overdraft occurs there is a transfer or overdraft in the Accumulator Dials to the Long Transfer Pin, which is actuated thus actuating the Connector Arm and the Stud on Left side of the Connector Arm will actuate the Inside Bail #41128 thus delatching the Inside Latch #41114 from Left Shift Arm. After the Inside Latch is delatched, the machine goes into the regular Division operation.

The above section shows that the Inside Latch holds the #41120 in place for a Right Shift, in case the Outside Latch #41113 has been delatched according to the Figures in the Accumulator Dials, until the Carriage has Aligned the figures in the Accumulator Dials with the figures in the keyboard.

SENSING FINGERS

On the left half of the Carriage you will notice there are several levers in front of the Dials. These are the Sensing Fingers. They determine the time that the Outside Latch #41113 will delatch, Pg. 77 (Red Cross Lines).

Notice under the Dials there is a Cam with a 'V' shaped notch. When there is a zero in the Dial this notch faces the front and is in line with the Sensing Finger, thereby allowing the Sensing Finger to move into the notch.

If there is a figure in the Dial, the 'V' notch will not be in line with the Sensing Finger, and the Sensing Fingers cannot move to the rear.

Place a figure in one of the center Dials in line with the Sensing Fingers. (The dials to the left and right of this Dial to have Zero's in them.) Try and push any of the Sensing Fingers to the Right of the Figured Dial to the rear. Even though there are Zero's in these Dials The Sensing Fingers will not go to the rear, because the Sensing Fingers interlock each other. Try the Sensing Fingers to the Left of this Dial. They will go rearward.

Whenever there is a figure in a Dial, the Sensing Finger in line with this Dial will interlock all to the Right, and not effect those to the left.

****

Machine in first position; place a #1 in 7th Keyboard Column; place #5 in 16th Accumulator Dial. Depress Division Keys, Rotate by Hand Crank.

Looking at machine from rear, notice all the levers and parts position the same as before.

Rotate by Hand Crank and notice the first revolution in the Subtract position will give an overdraft to the Long Transfer Pin which will actuate the Connector Arm, the Inside Bail and the Inside Latch.

Continue to rotate by Hand Crank and notice as the Carriage shifts from the first to the second position that the outside latch #41113 does not delatch from #41120.

Notice that the flat side of Cam #41177 (Pg. 58, Violet) is next to #41140 but that #41140 is not actuated. The reason being for this the Sensing Finger is blocking the Detecting Lever #41148 (Dark Blue) from moving to the rear, thus not allowing #41140 to actuate which would actuate #41138 (Yellow) and Outside Bail #41135 (Blue Cross Lines) and the Outside Latch #41113 (Pg. 67, Blue Check Mark).

Continue to rotate by Hand Crank and notice the action of the Inside Latch and the action of the Outside Latch. The Carriage will continue to shift to the Right till the figure in the 15th Accumulator Dial is aligned with the last column of the Keyboard, at which time the Outside Latch will be delatched, the Inside Latch will hold the #41120 A-bly in place for Right Shift until the figure in the Accumulator Dial is past the figure in the Keyboard column so the next Subtract cycle will give an overdraft to actuate the Long Transfer Pin, Connector Arm, Inside Bail and Inside Latch. When this happens, the #41120 will restore to the Right and the machine will go into a regular Division operation.

The preceding section shows the purpose of Sensing Fingers, the action of #41113 and #41114 Latches.

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DIVISION ALIGNER (CONTINUED)

(Delatching the #41113 and #41114 Latches in Last Carriage Position)

Carriage in first position, place #1 in Last Keyboard Column, Place #5 in last Accumulator Dial. Depress Division Keys, Rotate by Hand Crank.

Looking at machine from rear, observe the action of the parts and the Latches as the Carriage aligns to the Right.

Observe as the Carriage shifts into the Last Carriage Position to the Right, the Detecting Lever #41148, Page 58, (Dark Blue) moves inward for the reason of the short Sensing Finger #91528, Pg. 77 (Light Green). This action causes the delatching of the Outside Latch.

The last Right Shift Cycle with the Carriage in the last position will actuate the Override Pawl, Pg. 77 (Brown), which actuates #75095, Pg. 72 (Red) and the lower arm of #75095 actuates lever #41125, Pg. 72 (Green) to contact the extended lip in center of Inside Bail #41128 thus actuating Bail and delatching the Inside Latch #41114.

The Rear Arm of #41125, Pg. 72, with the Square Stud (Violet) is latched by the Latch on the Outside Bail #41135, Pg. 58 (Black), to keep the Inside Latch #41114 from relatching until the Right Shify Cycle is completed. When the Cam #41177 rotates so the round side actuates #41140, the Outside Bail is actuated to delatch from the square Stud of #41125.

The Add and Subtract Gate goes into the subtract position and will allow the figure in the Keyboard to be subtracted from the figure in the Accumulator Dials, until the overdraft can be accomplished then the machine will start to divide to the left normally.

The above section shows how the two Latches are delatched when the Carriage reaches the extreme Right Position.

****

There are a couple of other actions that take place on the STW in Division that do not take place on the Standard machine.

With Add Key down; depress Division Keys and rotate by hand. Observe the first revolution will cause the front tail on the Crow's foot A-bly to raise.

Observe the extended lip of the Division Latch #61340 contacts and latches this tail.

This is to keep the Clutch released during Division with the Add Key down. This is on machines prior to installing of parts, Per Service Letter 156.

With Add Key down, figures in Keyboard, depress Division Keys.

Rotate by Hand until the Carriage is shifting to the left in normal Division.

DIVISION ALIGNER (CONTINUED)

Pull down on the Division Stop Lever and notice the Keyboard does not clear when the Machines restores to normal. Trace from the Division Stop Lever the reason why? Pg. 56, (Yellow); Pg. 55, (Brown Cross Lines).

Write Answer:

DIVISION ALIGNER

1. Sketch parts in sequence that will cause the Inside Latch #4114 to be delatched from #41120 on overdraft.
2. Sketch parts in sequence that will cause Outside Latch #41113 to be delatched. No sensing Finger blocked out.
3. Sketch parts that will keep Outside Latch #41113 from delatching.
4. Sketch parts that cause Flag to be operated when in Aligning Operation.

DIVISION ALIGNER

1. On overdraft transfer pin A and Connector Arm B moves to front Stud X on Connector Arm, Cams inside boil C down delatching inside latch (#41114) from left shift Arm.

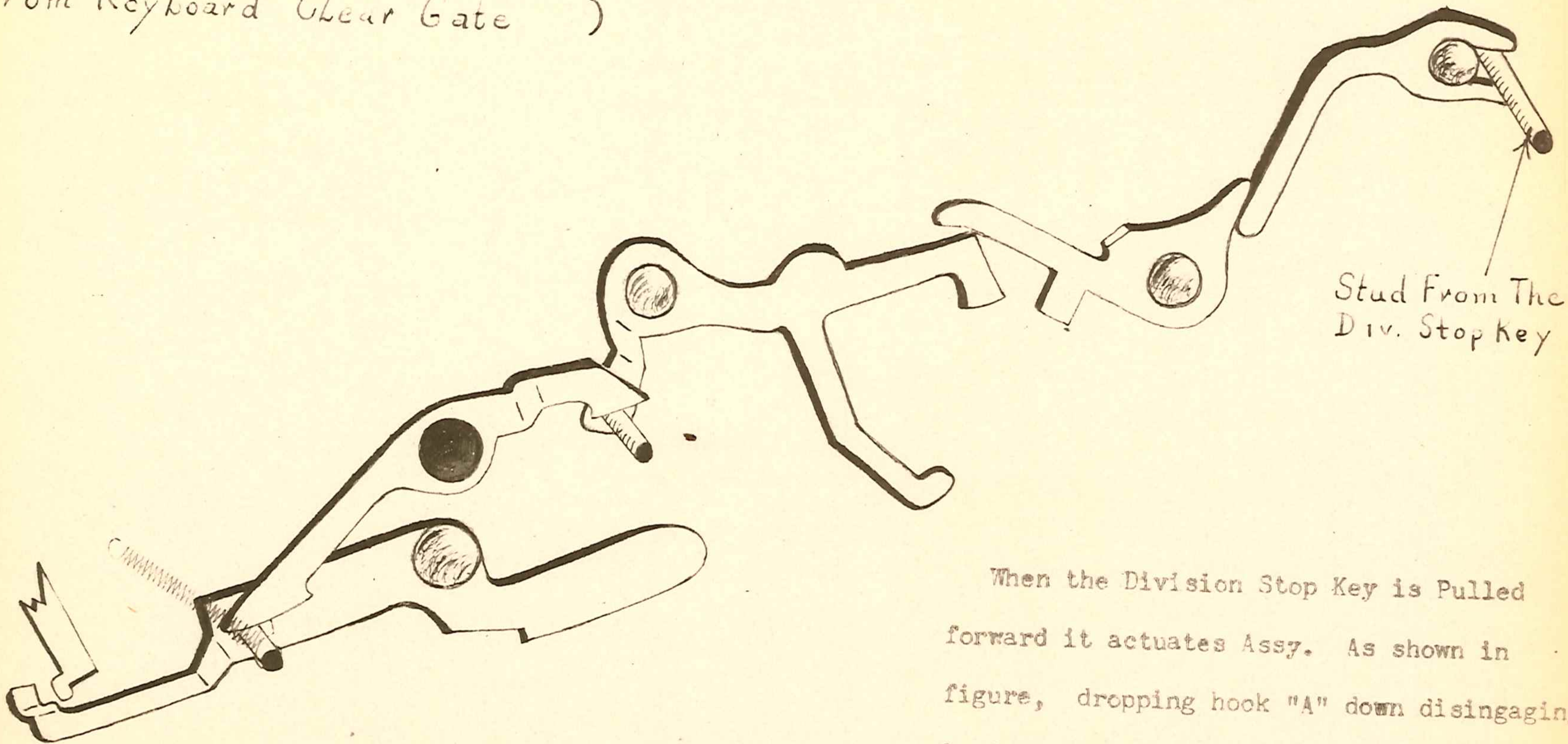
2. If sensing fingers are free; just right shift sensing fingers will allow detecting lever D and detecting Actuator E to move to the rear actuating bell crank F only when the flat side of cam G is facing down allowing projection o F to move (cam G faces down or only when Add Sub Gate is in neutral) moving connecting lever to the rear moving outside boil H and delatching outside latch (#41113) from left shift arm.

3. Dummy sensing finger(carr 1st pos. only) Sensing fingers will key outside latch (#4113) from delatching only if there are one or more mumbers in any of the left dials. Disabling Cam G will allow #41113 to delatch only when Add Sub gate is in neutral position.

4. When the shift actuating assy. is moved to the left by initial depression of Div Keys, controll slide K connected to left shift Arm Cam Assy L into pos. so flag M is actuated by stud N on #6 Actuator. As long as machine is in the aligning operation the shift Assy/ Will be held to the left holding flag M in pos. to be actuated by #6 Actuator.

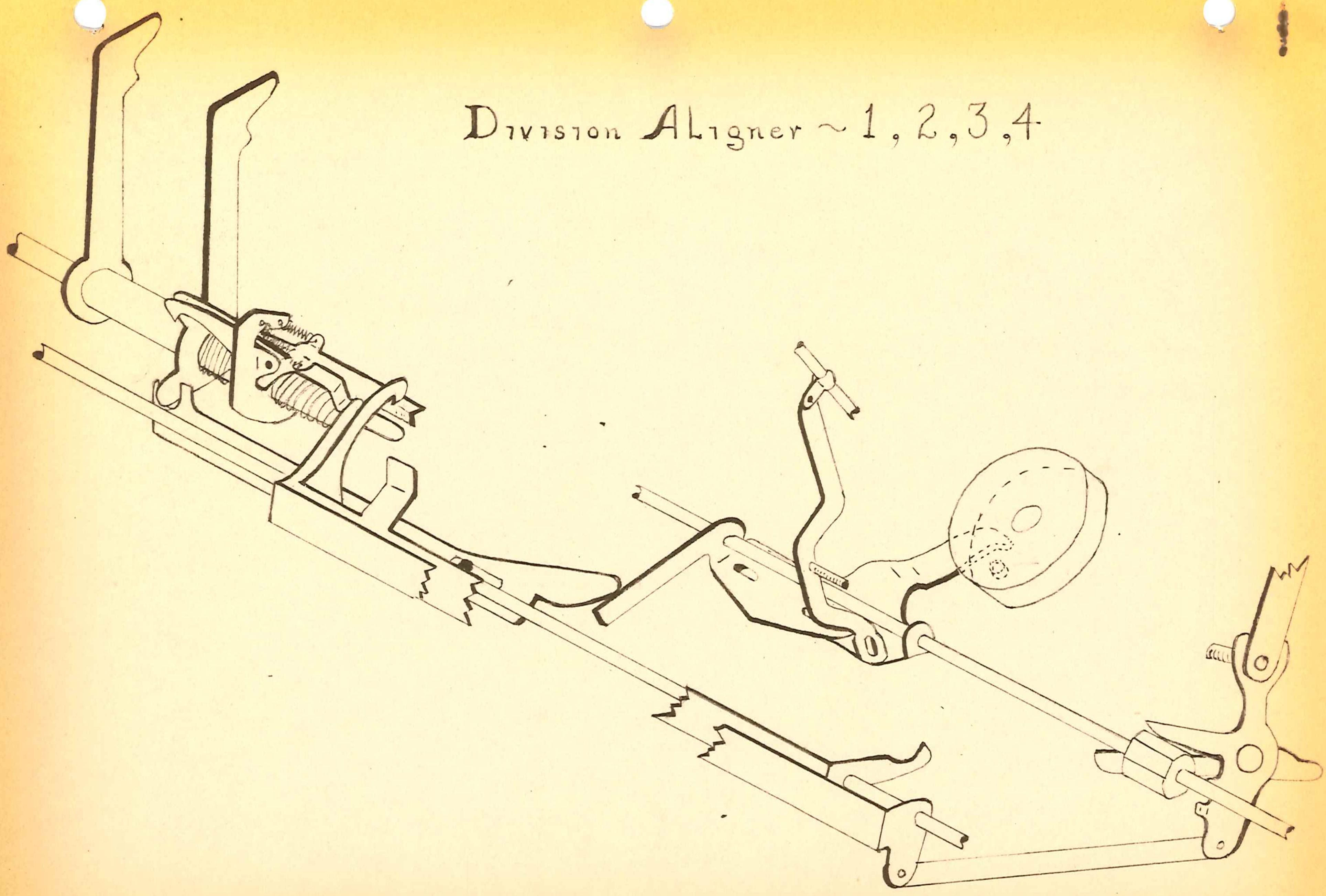
"Division Aligner"

{ Divison Stop Key Disengaged }
{ From Keyboard Clear Gate }


Stud From The Div. Stop Key

When the Division Stop Key is Pulled forward it actuates Assy. As shown in figure, dropping hook "A" down disingaging it from the keyboard clear gate "B".

Division Aligner ~ 1, 2, 3, 4



DIVIDEND TABULATION (OR ENTER DIVIDEND)

There are two types of Tabulation Operations. Cross Tabulation and Dividend Tabulation (or Enter Dividend). The Cross Tabulator Models (found on the D Model, Gray Line) accomplish two operations automatically; Return Clear and Right Shift (Positioning the Carriage to extreme Right). The Dividend Tabulator Models (found on C - ST Gray Line Models and STW, CW - DW accomplish Return Clear, Right Shift and the automatic entry of the Dividend. The Dividend Tabulator models have a row of Tabulator Stops on Top of the Carriage Rail, to position the Carriage at any desired point for entry of the Dividend. The Cross Tabulator Model does not have these Stops, thus no entry of Dividend.

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Operation of Dividend Tabulator

The Dividend Tabulator Key (or Enter Dividend) (Pg. 56, 57, Green Cross Lines) is depressed, the lower end contacting Roller on #21170 Shift Set up Actuating Lever (Pg. 56, Purple) moving forward end down and rear up so that Roller on rear end will actuate #64580 Tabulator Shift Set Up Lever (Pg. 56, 57, Purple) thus moving upper end of #64580 to rear and under #71638 Auto. Clear Disengaging Slide (Pg. 72, Blue Arrow).

The Tab. Key is latched by the Lock Bar #24560 (Pg. 55, Green Cross Lines).

Also when the Tab. Key is depressed, the Clutch is released and Micro-Switch closed by action of Tab. Key Bellcrank #71360 (Pg. 55, 57, Red Arrow) actuating #61305 Control Shaft oscillating lever (pg. 55, Orange Cross Lines), which is pinned to #61051 Clutch opening Shaft, thus rotating the Shaft and #61305 Control Shaft Oscillating Lever (Pg. 56, Orange) actuates #61300 Switch and Clutch Control Lever (Pg. 56, Orange). Upper end moving to front and contacts Hub of #21020 Switch Control Lever at which the Crows Foot is attached, thus actuating the Crows Foot Assembly to release the Clutch Release Dog from the Clutch. The Micro-Switch is closed by #21020 Switch Control Lever which extends to rear of machine to Switch Lever on Micro-Switch.

When the #61305 Control Shaft Oscillating Lever (Pg. 73, Blue) is actuated, the #61051 Shaft is rotated and #61345 Shift Actuating Lever Control Lever, located in Center of Shaft, is moved to rear thus moving #71324 Shift Actuating Control Link and #71325 Shift Latch Reset Eccentric to rear and positioning Hook end of #71325 to contact and actuate #71440 Shift Shaft Oscillating Lever, when Drive is rotated, which is pinned to #71367 Auto. Clear Levers Shaft thus actuating the Shaft and Shift Engaging Levers to engage Push Rods for a Left Shift and Return Clear Action. The Return Clear and Left Shift action is the first part of Tabulation.

On the first revolution of Drive Shaft the Hook Lever #71325 actuates the #71490 Auto. Clear Shaft Levers assembly which will allow #71390 Clutch opening Lever Upper (Pg. 73, Yellow Arrow) to move away from #24590 Shift Set Up Lever Latch (Pg. 56, Blue Cross Lines) to move to rear by Spring tension and against lip of #64575 Tabulator Shift Actuating Lever (Pg. 56, Blue Arrow) so to be in position to move under lip when #64575 is actuated.

When the Carriage moves into first position the Dials are cleared and the Carriage Shift Gear has an override action. When this override action occurs, the Right Override Pawl (Pg. 77, Green Cross Lines) actuates #71638 Auto. Clear Disengaging Slide (Pg. 72, Brown) which has a double result. One:--The Slide contacts and actuates #70170 Auto. Clear Disengaging Bellcrank (Pg. 56, Violet Cross Lines) which is connected to and actuates #71491 Auto. Clear and Shift Disengaging Bellcrank Link or #70160 (Pg. 73 - Pg.79, Blue Cross Lines) that actuates the Shift Engaging Levers to disengage the Auto. Clear Push Rod and Left Shift Push Rod to allow the Left Shift to become disengaged. Second:--The Slide pushes down on Upper End of #64580 (Pg. 57, Green Arrow), thus pushing down on Roller of rear Upper Arm of #64575 (Pg. 57, Blue Arrow) thus actuating #64575 so that Lower Arm with Lip (Pg. 56, Blue Arrow) is raised to allow Latch #24524 (Pg. 56, Blue Cross Lines) to move under the Lip to latch #64575. At the same time the #64575 is actuated, the Hook Lever of #64575 (Pg. 56 - 57, Brown Cross Lines) is moved to rear by Spring #1072, thus moving the Right Shift Clutch Controller into position for Shift Drive on end of actuator to be cammed into position for engagement with Right Shift Clutch Follower to cause a Right Shift operation. Also at the same time that #64575 is actuated, the #24575 Add-Subtract Gate Trip Lever and Link assembly (Pg. 56, Light Green) which is attached to #64575, is pulled to rear thus positioning the Trip Lever over the top of Lip on #64610 Plus-Minus Gate Delatching Lever (Pg. 56 -57, Yellow Arrow).

The Carriage now is in a Right Shift and continues in a Right Shift until a Tab. Key Stem, which has been depressed, (Pg. 77, Purple) contacts #351575 Tabulator Actuator Lever (Pg. 66, Yellow) which moves #24545 Tabulator Shift Actuator Lever (Pg. 56, Red Cross Lines) downward. The #24545 in its downward motion actuates the Trip Lever (Pg. 56, Light Green) down which contacts and moves the #64610 (Pg. 57, Yellow Arrow) so that the Roller on #64610 (Pg. 57, Purple Arrow) actuates #24540 Plus-Minus Gate Actuating Lever Latch (Pg. 55, Light Blue) from under lip on #24570 Add-Subtract Gate Setting Lever (Pg. 55, Yellow Cross Lines) to allow #1100 Spring to actuate #24570 so upper end contacts Roller (Blue Arrow) on #64550 Plus-Minus Gate Actuating Lever, thus actuating #64550 to move Add-Subtract Gate into position, through Clutch assemblies on #64550 and Gate Shaft, for every entry of Dividend. The upper end of #64550 (Pg. 55, Brown Arrow) actuates stud on #71595 which pulls #24560 Tab. Key Lock Bar to rear thus releasing Tab. Key.

At the same time that #24545 (Pg. 56, Red Cross Lines) is depressed as in above, the lower end contacts the Roller on #24525 Latch (Pg. 56, Blue Cross Lines) thus pulling #24525 from under the Lip on #64575 (Pg. 56, Blue Arrow). This action allows #64575 to restore to normal position thus allowing the Right Shift to become disengaged before the cycle which enters the figures in the dials occurs so the carriage will not shift when Add-Subtract Gate is in position. At the time the #64575 is delatched, the #24545 Trip Lever and Link (Pg. 56, Light Green) is restored to the front and away from the end of #64610 (Pg. 57, Yellow Arrow), which allows the #64610 to restore to normal position. The Trip Lever is held down and in front of #64610 as long as the Carriage is at the Tab. Key Stem which is depressed. The Trip Lever will raise when the Carriage is moved or the Tab. Key Stem is released.

The tripping of the #64610 to release Latch #24540 (Pg. 55, Blue) must occur almost at the same time the Latch #24525 (Pg. 56, Blue Cross Lines) is released from lip of #64575. If the #64575 is released before the Trip Lever #24545 (Pg. 55, Light Green) can depress #64610 before it releases the Trip Lever will slip off end of #64610 before it releases #24540 thus giving a failure of Dividend Entry. If the Latch #24525 is released too late then the #64575 cannot restore fast enough to disengage the Right Shift before the Cycle of entering the Dividend occurs, thus causing the Carriage to Shift with Gate in position.

As the #24570 (Pg. 69, Brown) is tripped for entry of Dividend, it actuates #64665 Plus-Minus Gate Relatching Link (Pg. 69, Light Blue) which pulls #64680 Plus-Minus Gate Relatching Lever (Pg. 69, Orange) to rear so upper end contacts extended part of #74025 Crows Foot (Pg. 69, Blue Arrow) to boost the #74025 to rear to keep Clutch released for entry of Dividend.

The #24570 (Pg. 69, Brown) is restored by action of Roller on Div. Drive Gear (Pg. 69, Violet Arrow) contacting #64680 (Pg. 69, Orange) which actuates Link #64665 (Pg. 69, Blue) to relatch #24570.

With no Tab. Key stem depressed the Carriage moves to extreme Right in Tabulation. When the Carriage reaches last position the Carriage Shift Gear overrides thus actuating Left Override Pawl (Pg. 77, Brown) which actuates upper end of #75095 Shift Throwout Lever (Pg. 72, Red) and lower end raises and contacts Roller on #75090 Actuating Lever-Shift Link Disengaging (Pg. 68, Blue Arrow) which contacts #71635 Tab. Key Release Lever (Pg. 72, Dark Blue) which actuates #71595 Tab. Key Release Lever (Pg. 55, Green Arrow) thus pulling #24560 Lock Bar to rear releasing Tab. Key.

When the Tab. Key restores it allows the #61325 Clutch Control Shaft and Levers assembly to restore (Pg. 73) so that #61345 located in center of Shaft delatches Latch #71344 (Pg. 65, Red) from Roller (Pg. 73, Red Arrow) to allow #71490 Auto. Clear Levers and Shaft assembly to restore, thus allowing #71390 (Pg. 73, Yellow Arrow) to contact and move #24590 (Pg. 73, Green Cross Lines) to delatch #24525 (Pg. 56, Blue Cross Lines) from #64610 to restore the parts and release Right Shift.

The Counter is blocked out during the entry of the Dividend, in other words the "1" is eliminated from the Counter Dial. When the

Dividend Tab. Key is depressed the bottom of it actuates #21170 (Pg. 56, Pruple) which actuates #64580 (Pg. 56, Purple) so that Roller on #64580 (Pg. 56-57, Orange Arrow) actuates #24555 Counter Blocking Lever Actuating Lever (Pg. 56, Purple Cross Lines) to move the Blocking Lever at upper end under the locking projection on #1 Counter Tooth and Lock Assembly. This is a presetting operation and as long as the Tab. Key is latched the #24555 is kept in position, but when the Key is released at the entry of Dividend the #24555 is released, however it does not restore because of Lip on #24570 (Pg. 57, Black Arrow) dropping in front of Lip on #24555 thus keeping the upper end of #24555 under the Locking Projection on the #1 Counter Finger Assembly thus keeping the Counter from operating when the Add-Subtract Gate is in position for entry of Dividend.

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Study the operation of Dividend Tab over several times to get it down pat. Just because you have read it through once doesn't mean you have completed the assignment.

DIVIDEND TABULATOR

1. Sketch parts in sequence that release Clutch on Dividend Tab Key.

2. Sketch parts in sequence that are pre-set on depression of Dividend Tab Key.

3. Sketch parts in sequence that are actuated on override action with carriage in First Position.

4. Sketch parts in sequence that cause the Add-Subtract Gate to be actuated. (From Tab Stop to Gate)

5. Sketch how Counter is kept from counting on entry of Dividend.

Sequence of Action Involved in Enter Divd or DivTab

1. Key latched down

2. Preset: 3 steps accomplished

    (a) Actuating tab shift set up lever 64580 - rear and under 71638
    (b) Setting up counter block out
    (c) Oscilating clutch control shaft to position hook of reset eccentric to catch upper stud of shift shaft oscilating lever 71440

3. Left shift and auto clear. Starting right, shift latch set-up

4. Carriage 1st position. Right over-ride. 4 steps accomplished

    (a) Disengage shift and auto clear engaging links
    (b) Actuating right shift
    (c) Latching of right shift
    (d) Add subtract gate delatch, trip link set-up.

5. Depressed tab stop to actuating add-subtract gate.

    Release of enter divd key.

    Disengaging right shift.

    Restoring trip link and lever to forward position.

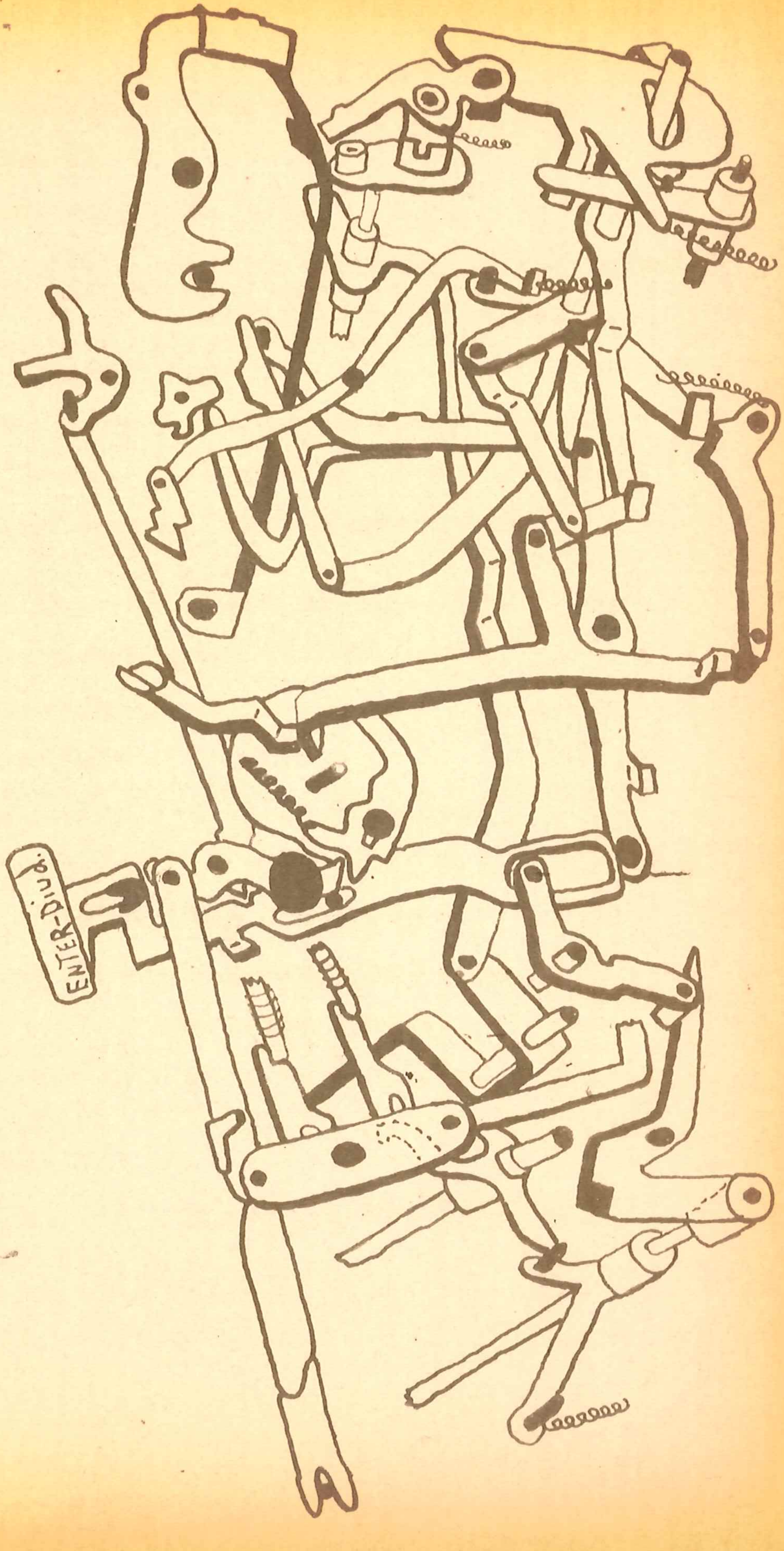
6. Action to keep clutch open and switch closed for entry of dividend.

    Relatching of add-subtract gate setting lever 24570

7. With no tab keys depressed, releasing enter divd key.

    Restoring all parts to normal or home position.

8. How counter is blocked. Out when key (and PRESET) is released.


ENTER-Divid.

Removing Dividend Tabulator Mechanism

1. Add-Subtract gate setting lever 24570 with spring 1100.

2. Spring 1023 - unhook from stud on RHS - RSF above rear end 64610, Plus-minus gate delatching lever. Leave spring on lever.

3. Springs 1014 and 1039. Unhook both at bottom end from stud on lever 24525, shift set-up lever latch.

4. Remove after snap washer 4019 from stud on 70170. Auto clear disengaging bellcrank.

   Remove after end of 71491, auto clear and shift disengaging bellcrank link let hang loose.

5. Remove 61595 (new part) from stud on LHS - RSF

   (a) Unhook spring 1149 from stud (leave on lever)
   (b) Remove snap washer 4129

6. Remove spring 1039 spring. Unhook from 64610 - leave on 24555 (or new part 24040)

7. Spring 1115, unhook from upper rear extension of 61920 (formerly 64580) Tab shift set up lever, leave on lever, unhook from bellcrank lifter paw. Shaft 41185

8. Spring 1031 to 24540, add-subtract gate actuating lever latch Leave on latch - unhook from stud.

9. Spring clips 4062, two of them on shaft 61587. Shaft, tab shift actuating levers.

10. Remove slip clutch 50096

    4 screws - 2085
    4 springs - 1018
    4 balls - 50007

SUPERMATIC SECTION TRACING OPERATIONS

These questions are to be completed the same as the Basic Tracing.

Clutch Releasing by Mult. Key: Accum. Mult. and Neg. Mult. Keys.

1. (a) Trace sequence of parts that disengage Clutch Release Dog from Clutch Dog when Mult. Key is depressed. (Ref. Pg. 75, Yellow; Pg. 58, 73, Purple; Pg. 56, Orange; Pg. 55, Light Green).

(b) Trace sequence of parts that disengage Clutch Release Dog from Clutch Dog when Accum. Mult. Key is depressed. (Pg. 75, 64, Bright Green; Pg. 73, Brown; Pg. 56, Orange, Pg. 55, Light Green.)

(c) Trace above section on depression of Neg. Mult. Key (Pg. 75, 64, Light Blue; Pg. 73, Bright Green; Pg. 56, Orange; Pg. 55, Light Green)

(d) Check the preceding operations and observe if the Micro-Switch is closed by the same action.
Yes ________ No ________

Now that you have traced the Clutch Releasing on the three Mult. Keys, has the fact occured that all release the Clutch by the same means? The only exception being the Clutch Control Shaft is operated at different points.

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Engaging of Left Shift and Auto. Clear Rod

2. The STW has a mechanism to Power Set the Left Shift and Auto. Clear Rod, where on the ST Models these were positioned by the direct depression of the Mult. Key; Accum. and Neg. Mult. Keys. The reason for the Power Set action allows for easier Key depression.

(a) Shift Carriage to the Right. Depress the Mult. Key and trace how parts are Pre-set for Power Setting of Shift Rods. Then the Power Setting action when Hand Crank is rotated. (Pg. 75, Yellow; Pg. 58, Pg. 73, Purple, Black; Pg. 58, 59, Orange; Pg. 73, Violet)

(b) Depress Accum. Mult. Key and trace same action as in (a). (Pg. 75, 64, 73, Bright Green; Pg. 73, Black; Pg. 58, 59, Orange; Pg. 73, Violet)

(c) Depress Neg. Mult. Key and trace same action as in (a). (Pg. 75, 64, Light Blue; Pg. 73, Brown, Black; Pg. 58, 59, Orange; Pg. 73, Violet)

3. Did you notice that only the Mult. Key both Shift Rods actuated? That on Accum. and Neg. Mult. Keys only the Left Shift is actuated?

Trace how Auto. Clear Rod is kept from being actuated.

(a) Depress Accum. Mult. Key (Pg. 64, Bright Green; Orange; Pg. 58, Red Cross Line)

(b) Depress Neg. Mult.Key. (Pg. 64, Light Blue, Orange; Pg. 58, Red Cross Lines)

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Carriage Clear Operation on Mult. Key

4. Depress Mult. Key and trace sequence of parts that clear the Accum. and Counter Dials. You'll observe the first part of the action is the same as in (2-a). Therefore, write the answer starting with the Auto. Clear Rod and Left Shift Rod. (Pg. 73, Violet, Orange; Pg. 72, Orange, Yellow; Pg. 77, 76, 77, Light Blue)

Disabling of Front and Rear Latches for Power Set Lever.

5. (a) Place a selection in Mult. Unit. Depress Mult. Key. Operate by Crank. Trace sequence of parts that disable Front Latch from Power Set Lever. You'll observe the first part of section is the same as (2-a). Write the answer from the time Hook Lever of #71520 (Pg. 73) engages Stud on #71440 (Pg. 73, Violet, Black Cross Lines; Pg. 56, Pg. 73, Pg. 64, Black Cross Lines)

(b) Trace sequence of parts that disable Rear Latch from Power Set Lever. Write the answer from the point of override action with Carriage in First Position. (Pg. 77, Green Cross Lines; Pg. 72, Brown; Pg. 56, Violet Cross Lines); (Pg. 73, Dark Blue Cross Lines for late style -- Pg. 79, for style possibly on your machine) (Pg. 58, 64, Blue Cross Lines)

(c) Trace the above questions on the Accum. Mult. Key and Neg. Mult. Key and observe if action is the same.

For disabling of Front Latch. Yes ______ No ______

For disabling of Rear Latch. Yes ______ No ______

6. When both Front and Rear Latches are disabled, the Power Set Lever actuates -- Front end down -- Rear end up.

What is the source of Power that actuates the Power Set Lever? (No color given.)

7. (a) The dropping or positioning of the Power Set Lever positions the parts that accomplish the Feeding out of the Segments; the raising of the Gate Engaging Levers; the Power Setting of the Gate into position. Selection of Unit. Depress Mult. Key. Trace sequence of parts that engage the Feed Pawl and Holding Pawl with the Segments to feed them out and the action of feeding out and holding of Segments when being fed out. (Start with Power Set Lever Dropping.) (Pg. 64, 61, Red; Pg. 75, Violet)

(b) Selection of Unit. Trace parts actuated, upon depression of Mult. Key, that will allow Plus Gate Engaging Lever to be raised when Power Set Lever drops; and then the parts and action that raise Plus Gate Engaging Lever when Power Set Lever drops off Latches (Parts actuated, Pg. 75, Yellow; Pg. 73, Red Cross Lines; Pg. 63, Red or Pg. 64, Red Cross Lines and Yellow) (Raising of Lever; Pg. 64, Green Cross Lines, Pg. 62, Red)

(c) After Power Set Lever drops and Gate Engaging Lever is positioned, trace how the Add-Subtract Gate is actuated into position. (Pg. 62, Green)

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8. (a) When the Segments feed to Zero, the Unit will shift to the Right and the Carriage will also shift to Right. Selection in Unit. Depress Mult. Key. Trace sequence of parts that cause the Unit to Shift. (Pg. 62, Yellow; Pg. 73, Brown Cross Lines; Pg. 59, Red; Pg. 75, Brown)

(b) Also the parts that cause the Carriage to Shift at Same time. (Pg. 73, Light Green; Pg. 72, Yellow)

(c) When the Unit Shifts to Right, the Feed Pawl must be disabled from the Segments. Trace how this is accomplished. (Pg. 61, 62, Brown)

9. (a) Selection in Unit. Depress Accum. Mult. Key. Trace parts actuated on depression of Key that will allow Plus Gate Engaging Lever to raise when Power Set Lever drops. (Pg. 64, Brown, Yellow)

(b) Selection in Unit. Depress Neg. Mult. Key. Trace parts actuated on depression of Key that will allow Neg. Gate Engaging Lever to raise when Power Set Lever drops. (Pg. 63, Blue)

10. (a) Trace on Accum. Mult. Key the action that will raise the Gate Engaging Lever when Power Set Lever drops.

Is this action the same for the Mult. Key? Yes___ No___

(b) Trace on Neg. Mult. Key the action that will raise the Gate Engaging Lever when Power Set Lever drops.

Is this action the same as for the Mult. Key and Accum. Key?

Yes___ No___

11. (a) Trace on Accum. Mult. Key the action that will place Gate into position when Power Set Lever drops.

Is this same as on the Mult. Key? Yes___ No___

(b) Trace on Neg. Mult. Key the action that will place the Gate into position when Power Set Lever drops.

Is this action the same as on the Mult. Key and Accum. Mult. Key? Yes___ No___

12. (a) Trace on Accum. and Neg. Mult Keys if the action for engaging the Feed Pawl with Segments and feeding of Segments is the same as on Mult. Key. Yes___ No___

(b) Trace on Accum. and Neg. Mult. Keys if the shifting of the Unit and Carriage is the same as on the Mult. Key.
Yes_____ No_____

(c) You will notice by the preceding questions on the Multiplication section that the disabling of the Front and Rear Latches; the dropping of the Power Set Lever; the actuation of the Gate into position by the Power Set Cam; the engaging and disengaging of the Feed Pawl; the shifting of the Unit and Carriage is exactly the same on the Mult. Accum. and Neg. Mult. Keys. The only difference is the pre-setting of the Plus Gate Engaging Lever by the Mult. and Accum. Keys and of course the Neg. Gate Lever by the Neg. Mult. Key.

13. (a) Depress Multiplier Zero Key. Trace sequence of parts that cause Multiplier Unit to escape. (Pg. 75, Dark Blue Cross Lines, Light Green Cross Lines)

(b) Depress #1 Multiplier Selection Key. Trace sequence of parts that cause Unit to escape. (Pg. 75, Black Cross Lines, Light Green Cross Lines) (Try other Keys)

(c) Depress #1 Multiplier Selection Key. Trace sequence of parts that release Sector and stop it at proper position. (Pg. 75, Black Cross Lines; Pg. 61, Yellow; Pg. 75, Yellow Cross Lines) (Pg. 61, Orange; Pg. 75, Orange Cross Lines)

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Multiplication Clear Key

14. (a) Depress Mult. Clear Key. Trace sequence of parts that actuate Clutch Release Dog from Clutch Dog. (Pg. 75, Red; Pg. 58, Light Green; Pg. 73, Red; Pg. 56, Orange; Pg. 55, Light Green)

(b) Selection in Unit. Depress Mult. Clear Key. Trace sequence of parts that pre-set for Power Setting of Left Shift Push Rod; then the actual Power Setting when Crank is rotated. (Pg. 75, Red; Pg. 58, Light Green; Pg. 73, Red, Black; Pg. 58, 59, Orange; Pg. 73, Violet)

(c) Depress Mult. Clear Key. Trace sequence of parts that disable Return Clear Engaging Lever from Auto. Clear Rod. (Pg. 58, Light Green; Blue Arrow, Red Cross Lines)

15. You'll observe that the Front Latch for Power Set Lever is actuated during a Mult. Clear Operation, and the Rear Latch is not actuated even when the Carriage is in First position and there is an override action.

Trace sequence of parts that keep Rear Latch from operating during a Mult. Clear operation when the override action takes place. (Pg. 75, Red; Pg. 58, Brown Cross Lines)

16. The STW has Instantaneous Correction of the Segments of the Mult. Unit. This feature does not exist on the SW or the Gray Line S and St Models.

Place a few figures in the Unit and with cord plugged in depress Mult. Clear Key. Observe action. Try the same operation by using Crank.

You'll observe when using Crank that the Segments may not restore to the Zero Latches unless the Crank is turned with speed. This will be explained later.

You'll notice when the Mult. Clear Key is depressed the Shift Drum for Mult. Unit is raised by the action of the Mult. Clear Key. (Pg. 40, Par. 138)

This is accomplished by the rear of the Correction Lever contacting the extended stud on right side of Mult. Shift Clutch Lever (Pg. 58, Red Arrow; Pg. 73, Brown Cross Lines), thus actuating the Lever and raising the Drum to bring the Shift Pawl into mesh with the teeth of the Shift Rack.

Observe the Mult. Shift Clutch Lever moves independed of the Carriage Shift Shaft. This is accomplished by the arrangement of an open Clutch on the Lever to the Clutch that is pinned to the Shift Shaft.

The Multiplier Unit immediately starts to shift to the right but does not feed out each sector as in the Standard machine. The Power Set Lever is not actuated on Mult. Clear on the STW. As the Mult. shifts to the right and Setting Pins are restored by the Restore Finger A-bly and the sectors turn to the #9 position.

As the Unit moves into the last Shift operation or restores to the "wall" the Setting Dial Restore Cam, #71515 (Pg. 73-59, Blue Arrow) contacts the Restore Mechanism on the Right Side Frame of the Unit and actuates it so the Restore Bail #81635, Pg. 75 (Purple) is actuated to restore the Sectors to the Zero Latches.

(Note: On early models with Setting Dial Restore Cam, #71320, as shown (Pg. 81, Red), by hand operation the Sectors will not restore to the Zero Latches because the throw of the Restore Mechanism is not enough, caused by the Shift Pawl dropping off the Shift Rack allowing the Unit to restore to Home position. On a Slow hand clearance with the Restore Cam in contact with the Restore Mechanism the Sectors should move back to the #2 or #3 position.)

Time #71500 Mult. Unit Shift Shaft A-bly one tooth in place of two teeth for the models with full Cam to keep Cam in contact with Restore Mechanism longer. On Models with half Cam (Pg. 73, Blue Arrow) the Sectors are restored fully and the timing of #71500 is two teeth. (This timing will come later in the course.)

Non-Clearing of Main Keyboard

On the S, ST machines the Main Keyboard would clear with the Add Key down when the Mult. Clear Key was used. On the STW this does not happen.

Observe that the lip of the Correction Lever, where attached to the Stud and Roller of the Mult. Clear Key, contacts Keyboard Clear Disabling Lever, #81145 (Pg. 59-74, Dark Blue) and this lever is attached to the Shaft that forms the pivot bar for the Keyboard Clear Gate (Pg. 74).

On the right end of this Shaft (Pg. 74-57, Black) the Keyboard Clear Disabling Bellcrank #81140 is attached. (Pg. 41, Par. 140, Part "A"). Observe that the yoke part of this lever fits onto Keyboard Clear Block Lever #81144 (Pg. 57, Black) which protrudes to the front of the machine. This lever has a lip on it that extends over the #81570 Keyboard Clear Link and Release Lever (Pg. 41, Par. 140) (Pg. 75, Violet).

Observe when the Mult. Clear Key is depressed the Keyboard Clear Link is actuated down and disengaged from the Clear Gate, by the action of the above-mentioned parts and action of parts (Par. 36, Pg. 20).

As long as the Mult. Clear Key is latched for a Correction Operation, the Keyboard Clear Link is held below the Clear Gate.

When the Mult. Clear Key is restored to normal, the above parts (Pg. 57, Black) do not restore immediately because of Keyboard Clear Block Release Lever #81150 (Pg. 41, Par. 140, Part "B") (Pg. 57, Orange Cross Lines) Latching onto Stud of Keybaord Clear Disabling Bellcrank.

The operation of Keyboard Clear Block Release Lever #81150 is as such: When the Mult. Clear Key is depressed the Keyboard Clear Disabling Bellcrank #81140 (Pg. 57; Pg. 41, Par. 140) is actuated so rear end with stud "A" moves down, when this happens the Keybaord Clear Block Release Lever #81150 is latched onto this stud by the action of Spring #1133. The lower end moving to the rear and upper end to the front. At the end of the Correction operation the Mult. Clear Key restores, but the Lever #81140 does not because of the Latching action of #81150, thus keeping the #81570 below the Clear Gate until the Add Pitman has made its rearward travel, during which time the #81570 is actuated to the rear and the Square Hub of the center stud on #81570 contacts and delatches #81150 from #81140. Should the #81150 fail to hold #81140 after Mult. Clear Key has restored, the Keyboard would clear.

Repeat Multiplication

(Constant Multiplier)

17. The Repeat Multiplication feature is a mechanism for locking the Segments at their original selected number and using them repeatedly without re-selecting.

Place a selection in Unit. Observe when pulling the Repeat Lever to the front that the Position Selector Lock #81320 (Pg. 63, Brown; Pg. 39, Par. 134, Part "A") actuates so the Hook end Cams into the teeth of the Position Selector #71510 (Pg. 54, Blue; Pg. 39, Par. 134 "B") and remains in this position.

> Reason: Latch #81325 (Pg. 40, Par. 135, Part "A"; Pg. 63, Violet) moves under the Square Stud "B" on rear of Position Selector Lock.

To release the Latch depress the Mult. Clear Key. This is the only way for the Repeat feature to be released on early Model STW. The releasing will be explained later.

The above is how the Position Selector #81320 is locked in position when actuated on the early Model STW. The later Models have a different method and instead of depressing the Mult. Clear Key to release the Lock, the Repeat Key is pushed to rear to release the Lock.

The Repeat Key has a Stud which slips into an indentation on Lever (Yellow) (Pg. 64-A) and locks into this position. The Position Selector Lock actuates as mentioned previous, however the Square Stud "B" (Pg. 40, Par. 135) has been eliminated. The Bail (Pg. 79-A, Brown) has been changed in design as shown on Pg. 64-A, Red).

The Bail (Pg. 79-A) controlled the depth the Latch engaged with Square Stud on the early models and was the means of releasing the Latch when Mult. Clear was depressed. On the later Models the Bell acts as an interlock for the Mult. Clear Key by the right end swinging under the stud on the bottom of the Key, thus keeping the key from being depressed.

Observe when the Repeat Lever is pulled to the front that the Ring Lock Bail #81639 (Pg. 75, Orange; Pg. 40, Par. 137 Part "A") is engaged with the Ring Locks at the Upper rear of the Segments and remains engaged.

> Reason: The Position Selector Lock actuates the Ring Lock Bail by means of Links #81343-#81344 and Segment Ring Lock Bellcrank #81345 (Pg. 62-63, Green Cross Lines) (Pg. 40, Par. 137). The Selector Lock being latched will keep Ring Lock Bail in place.

(Note: The Segments are very much the same as in the Standard machine with the exception of the addition of the Ring Lock. The Ring Lock is separate from the Main Segment. That is, when the Segment is selected to a number, both the Segment and the Ring Lock move to the selected position. However, when the Ring Lock Bail is engaged with the Ring Lock it holds the Ring Lock from restoring when the Segment is fed to the Zero Latches and when the Segments are released from the Zero Latches upon the return of the Unit to the Repeat position the Segment is stopped, in the same position as originally selected, by the Ring Lock.)

Observe when the Repeat Lever is pulled to the Front that the Escapement Pawl Control Link #81130 (Pg. 63, 64, Light Green) is pulled to the front by the action of the Position Selector Lock. As Escapement Pawl Control Link is moved to the front, the #1012 Spring actuates Escapement Pawl Disabling Slide #81340 (Pg. 64, Violet) to bring lower end against Square Stud on #31655 (Power Set Lever).

With a Selection in Unit, Repeat Lever down, depress Mult. Key. Operate by Crank. Observe when the unit completes the last shift to the Home position it does not stay in this position, but returns to the originally selected position.

This is accomplished by the Escapement Pawl Disabling Slide (Pg. 64, Violet) moving over the Square Stud on Power Set Lever when it drops at the beginning of the Mult. Operation, so when the Unit restores to the Home position the Release Bar A-bly (Pg. 54, Yellow) will raise the PowerSet Lever Relatch Lever #31680 (Pg. 64, Brown Cross Lines) and restore the Power Set Lever thus causing the Square Stud to raise the Escapement Pawl Disabling Slide so upper end contacts and actuates the extended end of the Holding Pawl, thus delatching it from the teeth of the comb, which allows Unit to restore to the original Selected position.

The Unit is stopped at the selected position by the Position Selector Lock being engaged with Position Selector, thus keeping Position Selector from moving when the Release Bar A-bly contacts the Adjustment Part #71512 (Pg. 54, Violet) of Position Selector. The Unit is kept from moving all the way to the left by the #1131 Spring attached from Unit to Release Bar AObly (Pg. 54, 75, Green Arrow).

Observe as the Unit restores to the selected position the Segments are delatched from the Zero Latches and will select to their original position. This is accomplished by the restoring action of the Power Set Lever, raising Escapement Pawl Disabling Slide #81340; attached at top is Lever that extends to the rear end downward to attach Zero Latch Releasing Bail #81335 (Pg. 63, Black), thus actuating Bail forward to release the Zero Latches from the Segments as the Unit moves to the Left.

When the Repeat Lever is pulled to the front, the Lever #71585 (Pg. 64, Blue Arrow) is actuated so hook end raises and engages the stud on #71550. This is to disable the Instant Carriage Return mechanism from operating on Repeat Mult.

As was mentioned previously, the only way to release the Repeat feature is by the Mult. Clear Key. This is accomplished by the Release Bail #81310 (Pg. 59, Yellow) being actuated by the Mult. Clear Key to delatch the Latch (Pg. 40, Par. 135, Lever "A") from the Square Stud "B". When the Latch is delatched, the Spring #1028 at rear of #81345 (Pg. 62, Violet) restores the Repeat feature to normal.

18. Instant Carriage Return

This is a feature that allows the Carriage to return to the Left upon the depression and release of any Mult. Selection Key. There are two type mechanisms existing on machines, however, the feature has now been eliminated.

With power on, Carriage out of first position, Multiplier Unit in Home Position, Depress and release a Selection Key; the Carriage will return to the second position and the machine restores to normal.

Observe with the Mult. Unit in home position that the Stud "A" (Pg. 39, Par. 131) on Shaft "D" rests on the hub of the left side frame of the Mult. Unit, and is close to the beveled edge of this hub. When a Selection Key is depressed and released the Unit escapes to the Left and the Stud cams into the beveled edge of the hub. The Stud drops for the reason of the #1114 Spring on the Left side of the Machine. This #1114 Spring is attached to the Link of #71550, thus pulling #71550 and actuating the Shaft to which the Stud is attached.

When this action occurs, the Lever #71550 on the left end of the Shaft, that has a Stud on the lower end, is actuated to the rear and contacts and actuates the upright arm #61285 (Pg. 64, Red Arrow) from the left end of the Main Clutch Releasing Shaft thus actuating the Shafts and the parts connected to it to release the Clutch, close the Micro-switch and set up the parts for the Power Actuated Shift to return the Carriage to the second position. (The action of the Shift engaging is the same as the Return Clear Mult.)

Notice when the Instant Carriage Return action takes place and the Carriage is returning to first position, the Return Clear Parts on Rear Bearing Plate are also operating, but as the Carriage reaches the second position the machine is restored to normal.

This action of not clearing the Carriage is accomplished by the Roller #3191 on the Front Carriage Rail contacting the Lever "B" (Pg. 39, Par. 132) which actuates and releases the pressure of the arm on #71550 from the upright arm of the Main Clutch Releasing Shaft thus allowing the Return Clear and Left Shift Clutch to disengage because the restoring action of the Main Clutch Releasing Shaft delatches the Power Shift Mechanism.

With the Add Key down, the keyboard does not clear on the Live Key action. (Pg. 20, Par. 36)

19. Multiplier Non-Entry

This is a feature to block the Counter from operating during Multiplication.

Trace how Counter is kept from Operating when M. N. E. Lever is pulled to front. (Pg. 75, 58, Violet Cross Lines; Pg. 20, Par. 36)

Trace how M.N.E. is disabled when Division Keys are operated. (Pg. 58, Yellow Cross Lines)

Study over the entire preceding information and tracing operations.

You must know how the machine operates to properly service it.

Just because you have completed this doesn't mean you are ready to move on. Sufficient time is allowed for you to study and learn the operation of the machine.

MULTIPLICATION

1. Sketch parts that restore Segments to Zero on Mult. Correction.
2. Sketch parts in sequence that will keep K.B. from clearing on Mult. Correction.
3. Sketch parts that lock Unit in selected position when Repeat Key is pulled down.
4. Sketch parts that lock Segments in selected position on Repeat Mult.
5. Sketch parts that will allow Unit to restore to original selected position on Repeat Mult. (Disengaging of Escapement Pawl)
6. Sketch parts that will cause Zero latches to be released when Unit restores to original selected position.
7. Sketch parts that will release Repeat Mult.

COMPLETE TRANSFER

The Complete Transfer Mechanism is a special feature on the W Line machines and allows transfering of figures in all Dials to use the maximum capacity of the Accumulator Dials.

A word of caution: The adjustments of the Complete Transfer Mechanism must be very close. The adjustment of the parts to which the Complete Transfer is adjusted must be proper, these are the adjustments of the Carriage. The Carriage clamps must be adjusted to hold the Carriage free but without lost motion. The Shift Rack adjustment must be proper for equal of the Gears.

When making or checking the Complete Transfer adjustments be very thorough. The following adjustments are given in proper order to make it easier to check and adjust. Know them in this order.

* * * * * * * * * * * * * * * *

The following information and illustrations are given to assist in understanding the operation of the Complete Transfer Mechanism.

To demonstrate the action of this feature, operate the machine as follows:

> With Carriage in First Position, Dials Clear, Place '1' in First Keyboard Column. Depress Minus Key. Observe that all Dials turn to (9's), depress Plus Key, Dials turn to Zero.

The Dials to the left of the #12 are rotated by the momentum of the #12th Dial. This action being accomplished by an arrangement of Large Gears on the Dial Shafts inside the Carriage Frame and several Idler Gears which mesh with the Large Gears to allow each Dial as it rotates to rotate the Dial to the left as the machine cycles.

Remove Carriage; Note--The Dials cannot be cleared by hand with the Carriage off unless the Disabling Bail #91603, Page 78, is held to the rear. This disengages the Idler Gears.

Observe the Accumulator Dials from #12 to #20 are special, with Large Gears (A) located on the Dial Shafts between the Carriage Frames. These Dials use a heavier Detent Spring #1124 than the regular Dials to their right. The Gear arrangement of these Dials are staggered with one having an extended tooth (B) from the Large Gear and one having a smaller tooth (C) located below the Large Gear. (Fig. 1, Pg. 2) These are Transfer Teeth for use when a Dial moves from the Zero to (9) or from the (9) to the Zero and they engage with the Idler Gears to turn the Idler Gears so they can turn the Dial in which they are in mesh.

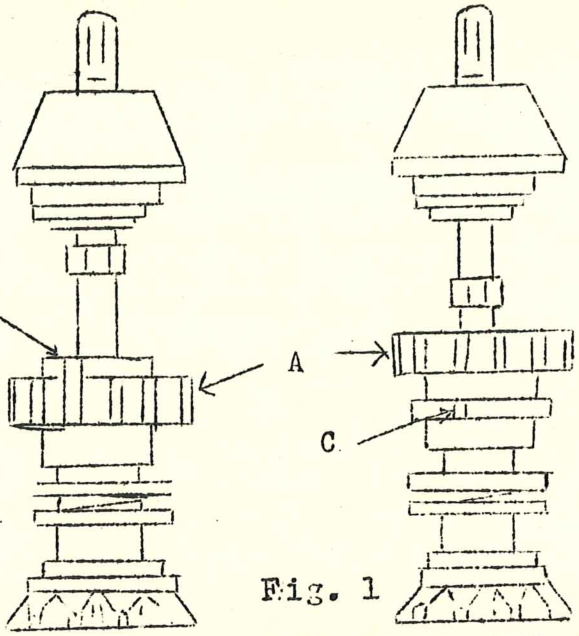


Fig. 1

COMPLETE TRANSFER IDLER GEAR SECTION

There is an arrangement of parts on the Left Front of the Carriage Frame which is the Complete Transfer Idler Gear Section. This consists of the Idler Gears (A) and (B) (Fig. 2), which are staggered to correspond with the Large Gears on the Dial Shafts.

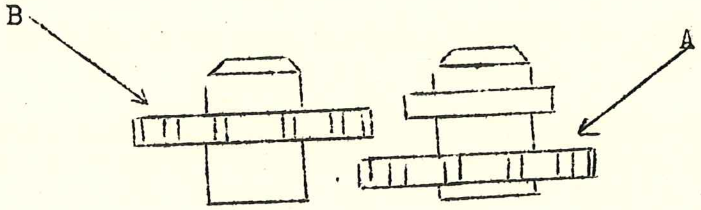
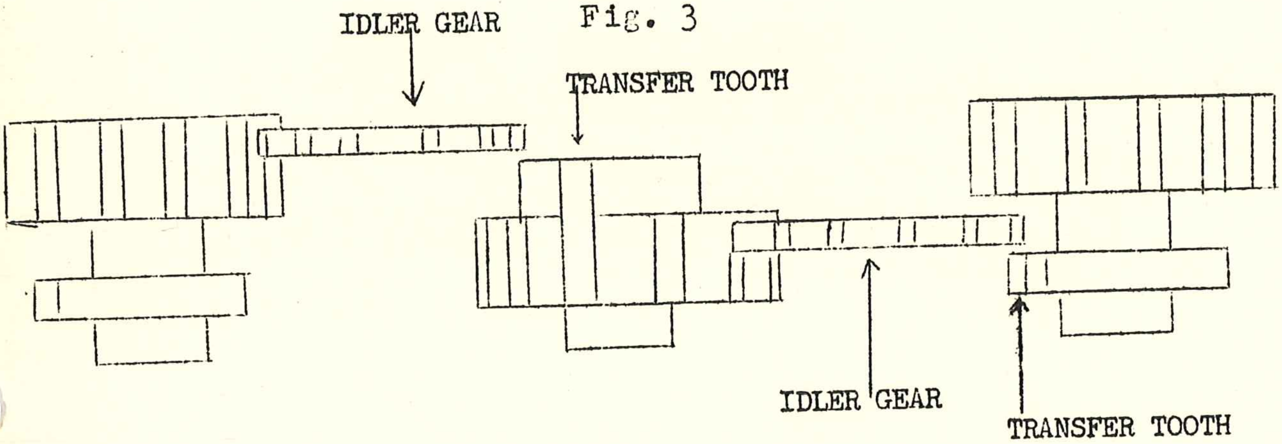


Fig. 2

The Idler Gears are always in mesh with the Large Gears. In the "up" or disengaged position, which is during a Carriage Shift, Division or Home position, the Idler Gears are not in line to be contacted by the Transfer Tooth of the Large Gears. (Fig. 3, Pg. 3) In the operations other thanabove the Idler Gears are in the "Down" or engaged position to be contacted by the Transfer Tooth. (Fig. 4, Pg. 3)

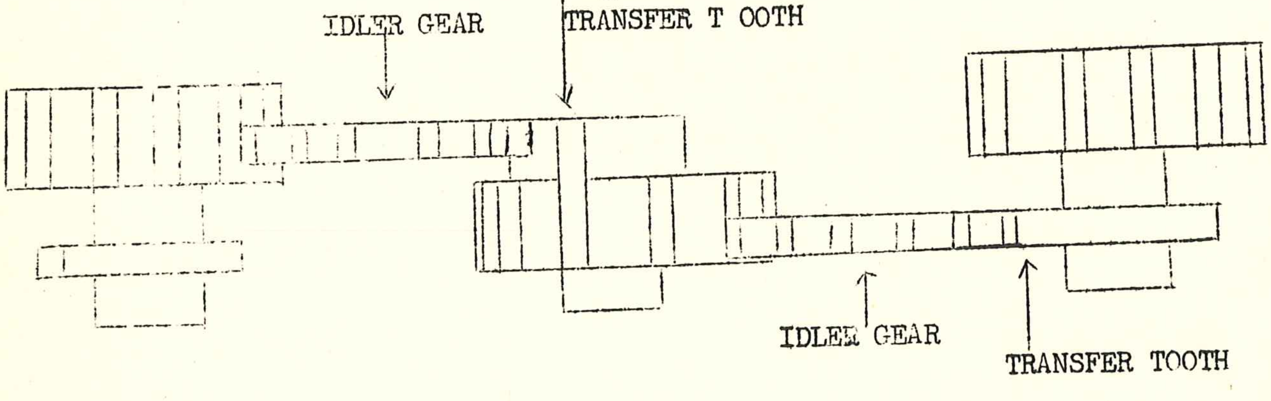
Disengaged Position

Fig. 3


IDLER GEAR
TRANSFER TOOTH
IDLER GEAR
TRANSFER TOOTH

Engaged Position

Fig. 4


IDLER GEAR
TRANSFER T OOTH
IDLER GEAR
TRANSFER TOOTH

(Continued on Next Page)

The engaging and disengaging of the Idler Gears are controlled by individual Bails. (Fig. 1) These are controlled by two methods.

First: By the Complete Transfer Blockout (A) (Fig.2), located on top of the Center Bearing Plate. As the Carriage Shifts to the Right, the left of this Blockout contacts the lower end of the Idler Gear Disabling Bails (B) actuating them one at a time so the Idler Gear (C) is held in an "up" or disengaged position from the Transfer Tooth (D) on the large Gears on the Dial Shafts, thus keeping the Idler Gears from contacting or turning any Dials for Full Carryover that are to the Right of the #12th Add and Sub. Gear, thus allowing the Transfer action to happen in the normal manner.

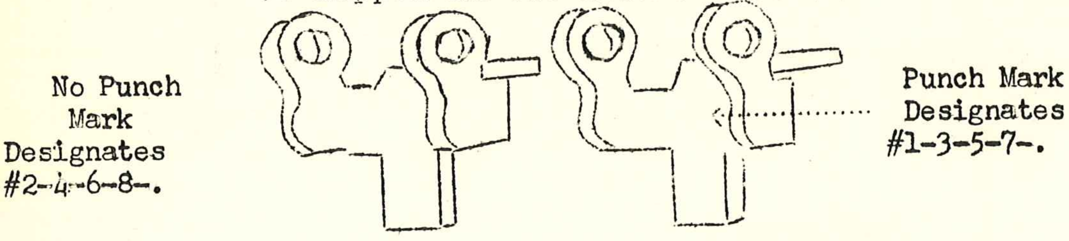
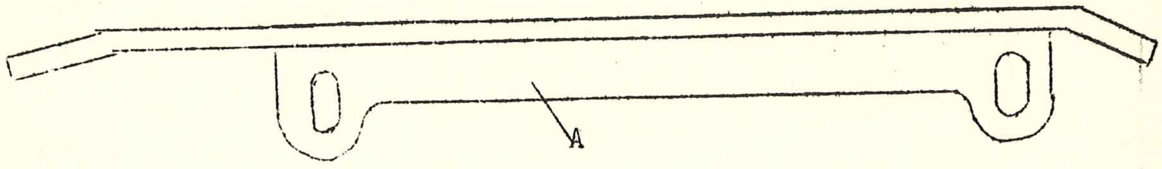

No Punch Mark Designates #2-4-6-8-.
Punch Mark Designates #1-3-5-7-.

Figure 1.

Fig. 1



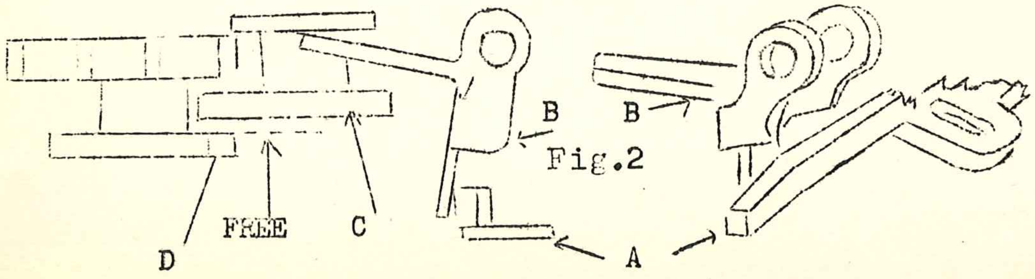


Fig.2

Second: Whenever the Add and Subtract Gate is in a normal position the Long Bail (A) for Complete Transfer Blockout that extends across the front of the individual Idler Gear Disabling Bails holds these Bail disengaged or in an "up" position. This long Bail is held to the rear by the Roller (B) on Arm (C). This Arm is held to the rear by the pressure of the Eccentric (D) on Arm (E). This pressure is exerted by the Heavy Spring (F) on Arm (E) (Fig. 3).

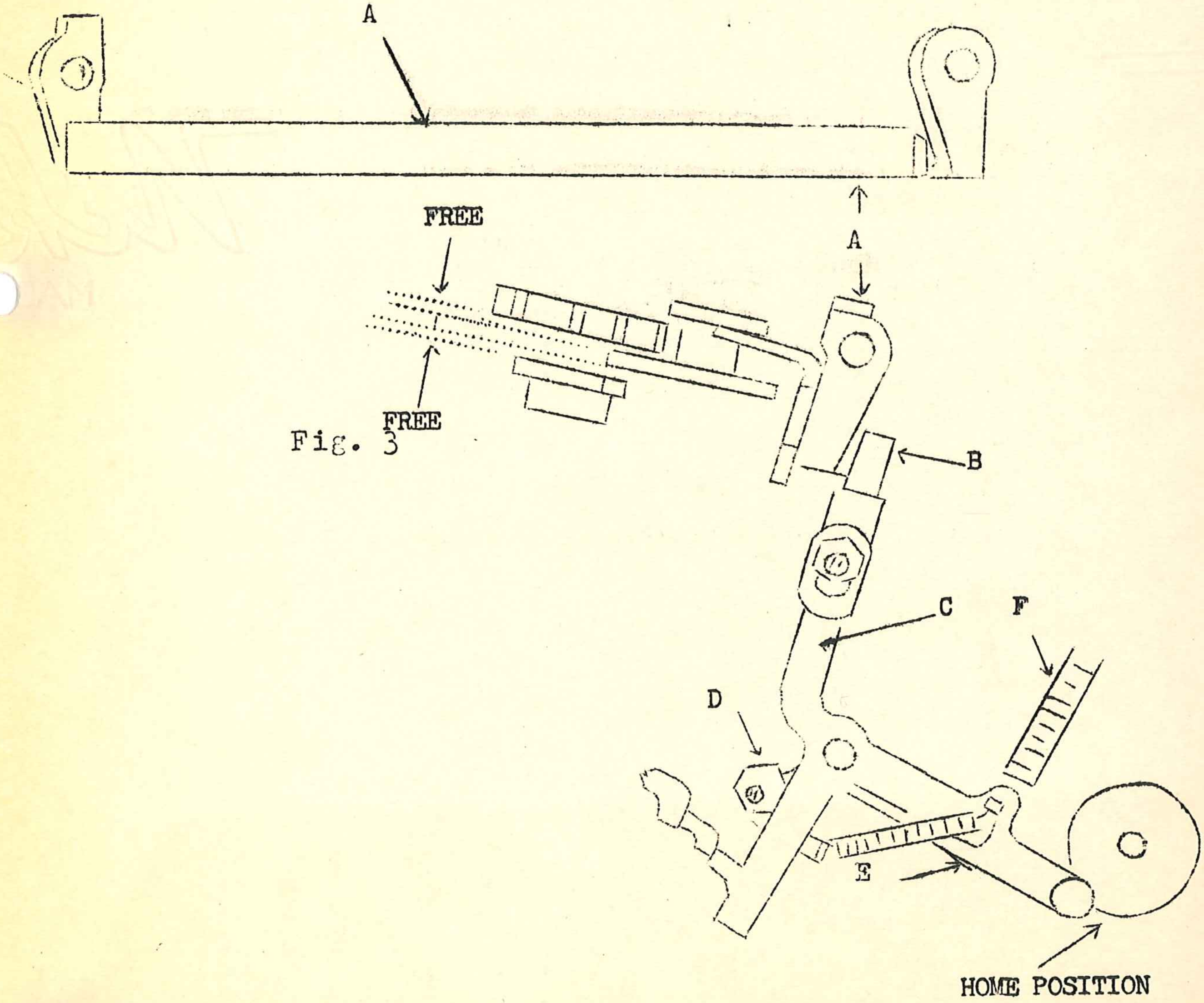


Fig. 3

When the Add and Subtract Gate is in Add or Subtract position, except Division, drive shaft rotating, the Cam (A) on Drive Shaft actuates Roller (B) on Arm (C) thus moving Eccentric (D) away from Arm (E). The pressure of the Springs (F) above the Idler Gears (G) lower them thus actuating the Individual Bails (H) which apply pressure on the Long Bail (I) which actuates the Roller (J) on Arm (E) to front thus allowing the Idler Gears to lower into engaged position to be in mesh with the Transfer Teeth on the Large Gears of the Complete Transfer Dials. (Fig. 4) Spring (K) also helps pull Arm (E) and Roller (J) away from Bail (I).

Fig. 4

In a Division Operation the Blockout (A) for Division is swung into place on Lower Part of Arm (B). Thus when the Drive Shaft rotates the Cam (C) actuates Arm (D) and Eccentric (E) moves away from Arm (B), but Arm (B) cannot move because of Blockout (A) thus keeping the Idler Gears Disengaged in Division. (Fig. 5, Page 7)

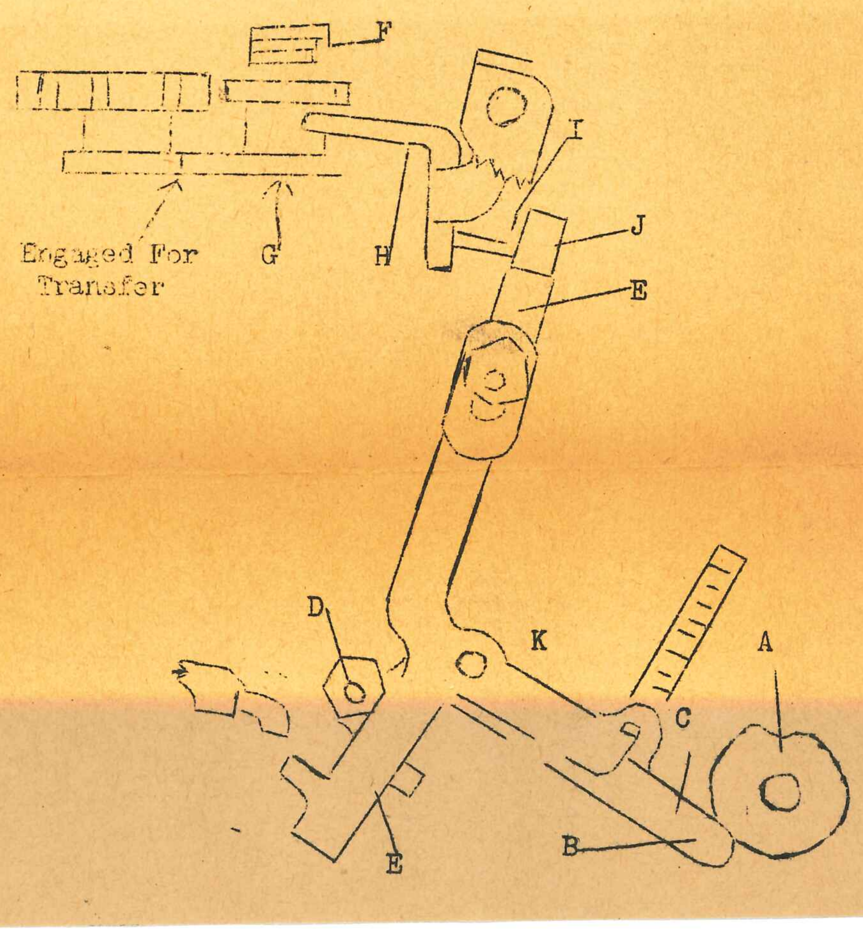


FIGURE 4

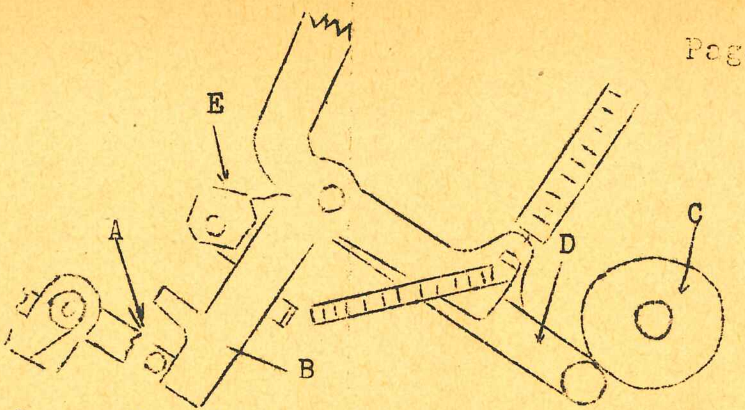


Fig. 5

In a Shift Operation the Add and Subtract Gate is in a Neutral Position, thus the Blockout (A) is in line with Lip (B) on Arm (C), thereby keeping Arm (C) from moving when Eccentric (D) is moved away from Arm (C). (Fig. 6)

When the machine is operating other than Division or Shift the Idler Gears are allowed to lower into a Transfer Position on each Cycle of the machine. Thus when the Dial in Line with the #12th Add and Subtract Gear transfer, the Idler Gear will be actuated thus turning the Dial to the left. If the Dials to the left of the Dial in line with the 12th position show "Zero" and the transfer is the result of Accumulation, the Dial will register one count. If the transfer is the result of a Negative action, the Dial in line with the 12th position will cause the next dial to the left to turn and that Dial will cause the next, etc., to the end of the Carriage.

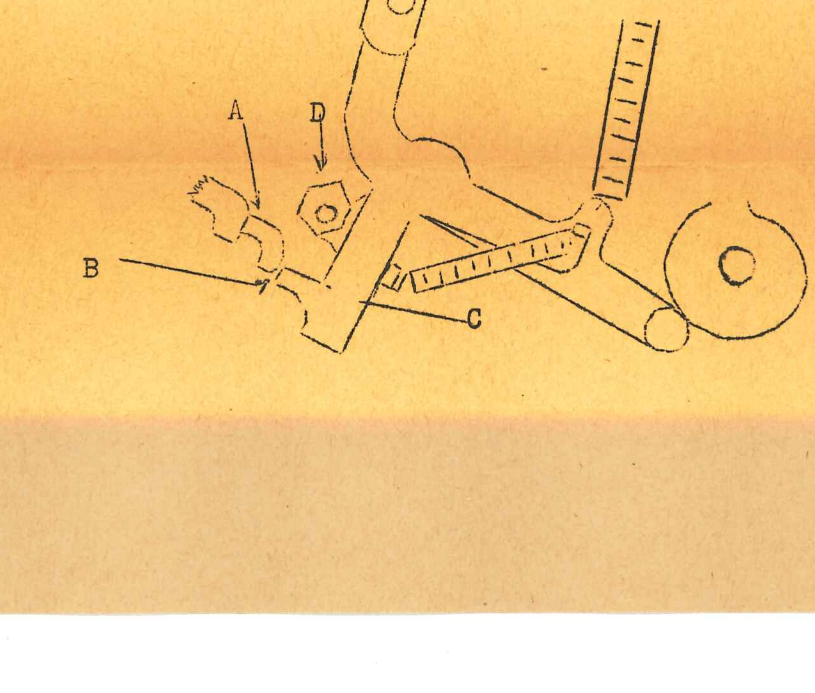


Fig. 6

ADJUSTMENTS

The adjustments here listed are in a suggested order best suited to eliminate Service Problems on Complete Transfer.

1. Make sure the Carriage is adjusted without lost motion because the Complete Transfer is adjusted to the Carriage.

2. BAIL FOR DISABLING COMPLETE TRANSFER IDLER GEAR:
   Remove Carriage. Manually depress the Complete Transfer Blockout B ail (A). The Individual Bails (B) should not touch Bracket (C) and none should have more than .005 between Blockout as shown in Fig. 1.
   To adjust; insert point of a screwdriver (D) or other suitable object under lower Tail of Individual Bail (B) and using Forming Tool (E) form upper Tail of Individual Bail (B) upward to lessen clearance or downward to increase. (Fig. 2)
   Purpose of Adjustment is to insure equal control of the Idler Gears for adjustment #3 and #5. Be sure to check this adjustment before making #3 or #5.

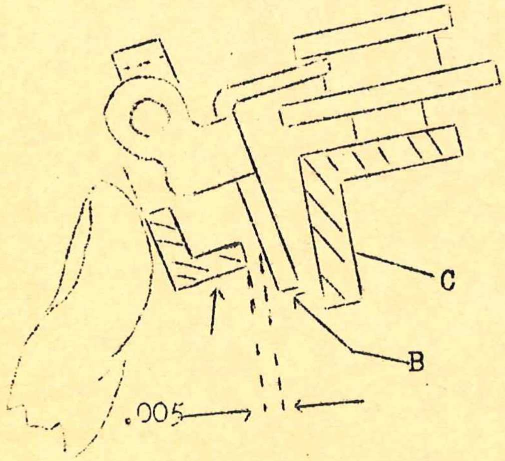


Figure 1

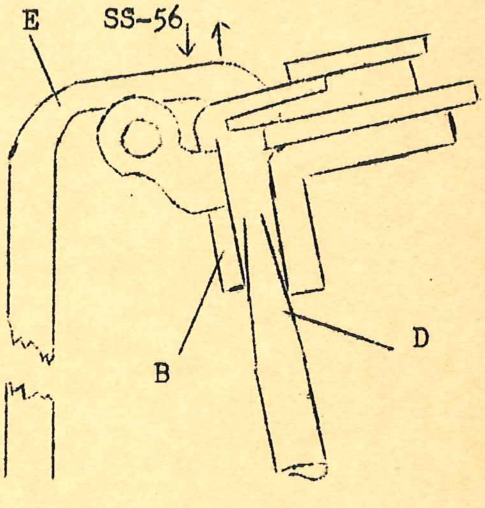
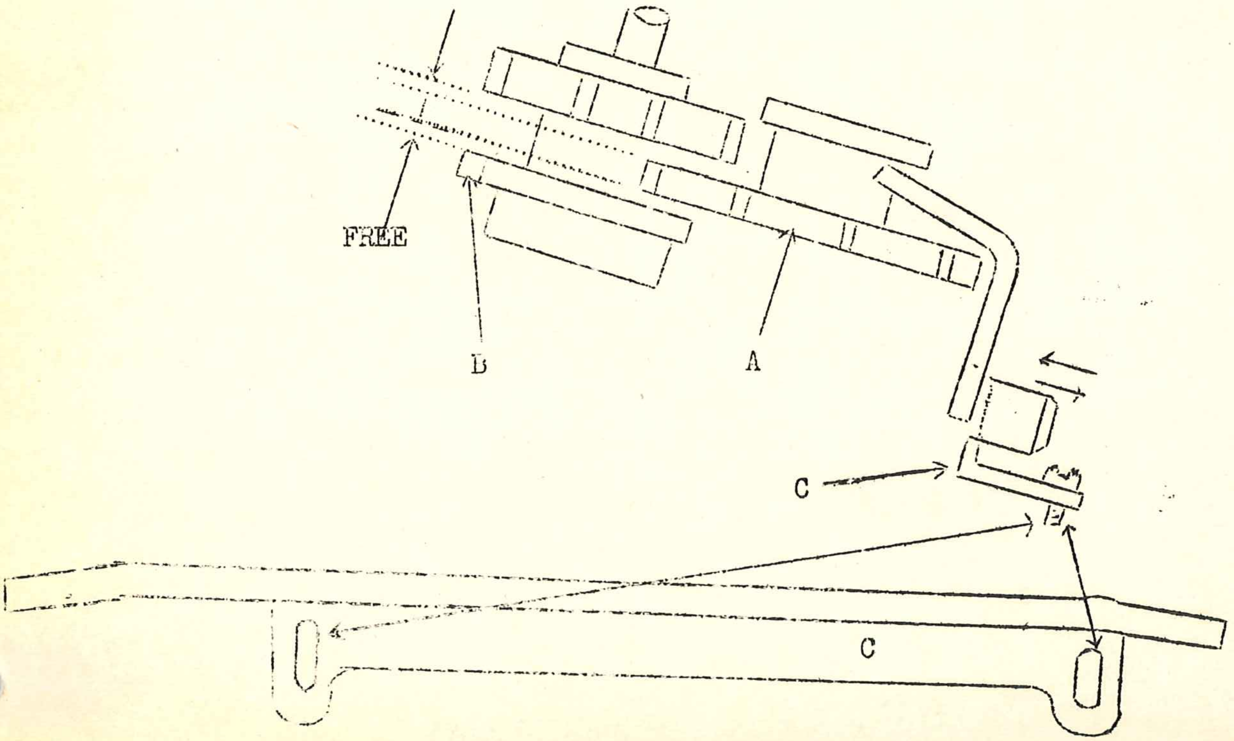


Figure 2

3. COMPLETE TRANSFER BLOCKOUT:
Carriage in Extreme Right Position all Idler Gears (A) should be disengaged from Transfer Tooth (B). By placing Carriage in half shift between last position and next-to-last-position, use the PICK UP TEST by rotating the Dials by the Twirlers from '0' through '9' to '8' and back through '9' to '1'. Do this several times on all Dials. No Flicker or attempt to transfer to the next Dial to Left indicates the Idler Gears are not being held high enough by the Blockout. Use DETENT CHECK to test for Blockout being too far to rear which will cause a drag to the Dials. To test; turn Dials slightly out of Centralized position and release to see that they return to center of Detent. (Binds caused by the Sensing Fingers will cause this drag or in the Dial Bearings in carriage Frame.)

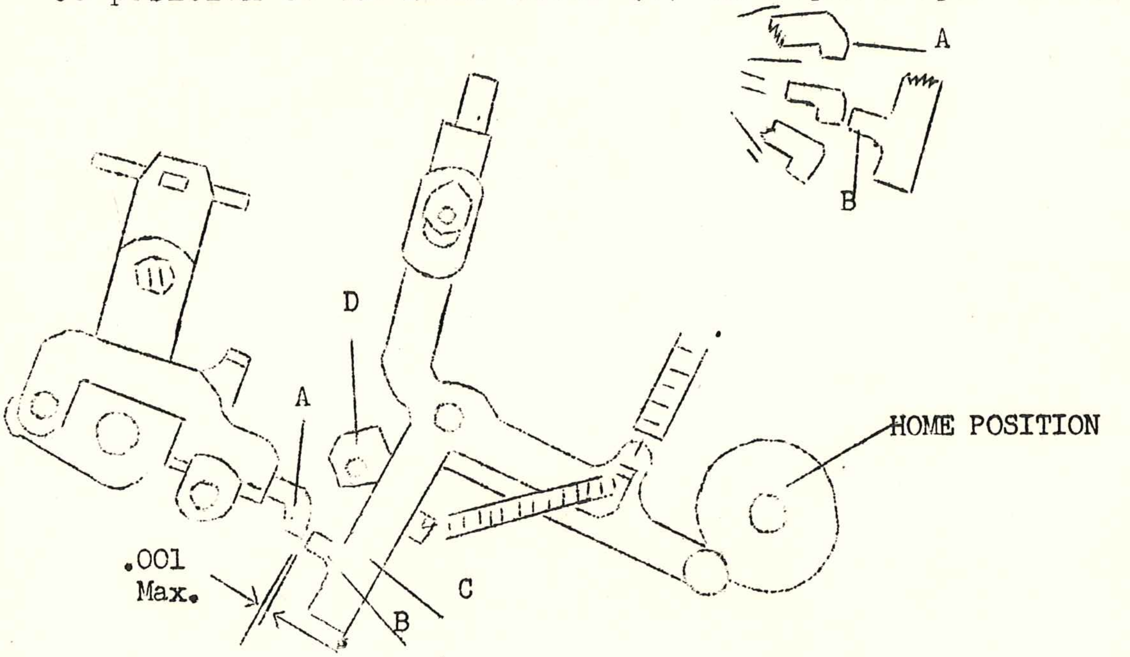
(Note: Adjustment #2 must be proper to obtain equal control of the Idler Gears by the Blockout.)

Adjust Blockout (C) to front to Lower Idler Gears and to the Rear to Raise Idler Gears keeping adjustment even and straight. (The Rear Carriage Clamps must be adjusted properly to hold Carriage steady) After adjusting use PICK UP TEST AND DETENT CHECK.



4. COMPLETE TRANSFER DISENGAGING ARM (1st Adjustment)
Carriage in First Position. Machine in Home Position, there should be no more than .001 Clearance between Lever (A) and Projection (B) on Lever (C). Adjust by Eccentric (D). VERY CLOSE ADJUSTMENT.
Test by observing the point of contact between Lever (A) and Projection (B) and rocking Add and Sub. Gate back and forth. Lever (A) should be VERY close but not dragging on Projection (B). Check in 7th position also.

(Excessive clearance at this point will allow the Idler Gears to lower during a Carriage Clear Operation and could cause a lock up if the Idler Gears contact the Transfer Teeth of the Large Gears on the Dials as they are cleared.) (Too close; Lever (A) will not return to position to blockout Lever (C) in a Clear Operation.)



5. DISENGAGING ARM (2nd Adjustment)

Carriage in First Position. Trip Clutch, turn Drive Shaft (A) one half turn (Blank Operation). Use PICK UP TEST (per Adjustment #3). If dials tend to Flicker or turn, adjust Eccentric (B) to raise Idler Gears. If Dials tend to drag (use DETENT CHECK per Adjustment #3 adjust Eccentric (B) to lower Idler Gears. (Page 11, Fig. 1). VERY CLOSE ADJUSTMENT (Adjustment #2, Page 8, must be proper to obtain a good setting on this adjustment.

5. (Continued)

The Carriage Clamps again play an important part in this adjustment.

If this Adjustment is too low the Idler Gears will be in contact with the Transfer Tooth of the Large Gears and will cause a lock up in the Carriage Clear operation.

If too high there will be pressure against the Lever (A) and Projection (B) in Adjustment #4, causing a drag on Lever (A) as Add and Sub. Gate moves back and forth. Also the Dials may tend to drag. (Use DETENT CHECK.)

Try DETENT CHECK 6n #20th Dial with Carriage in 7th position.

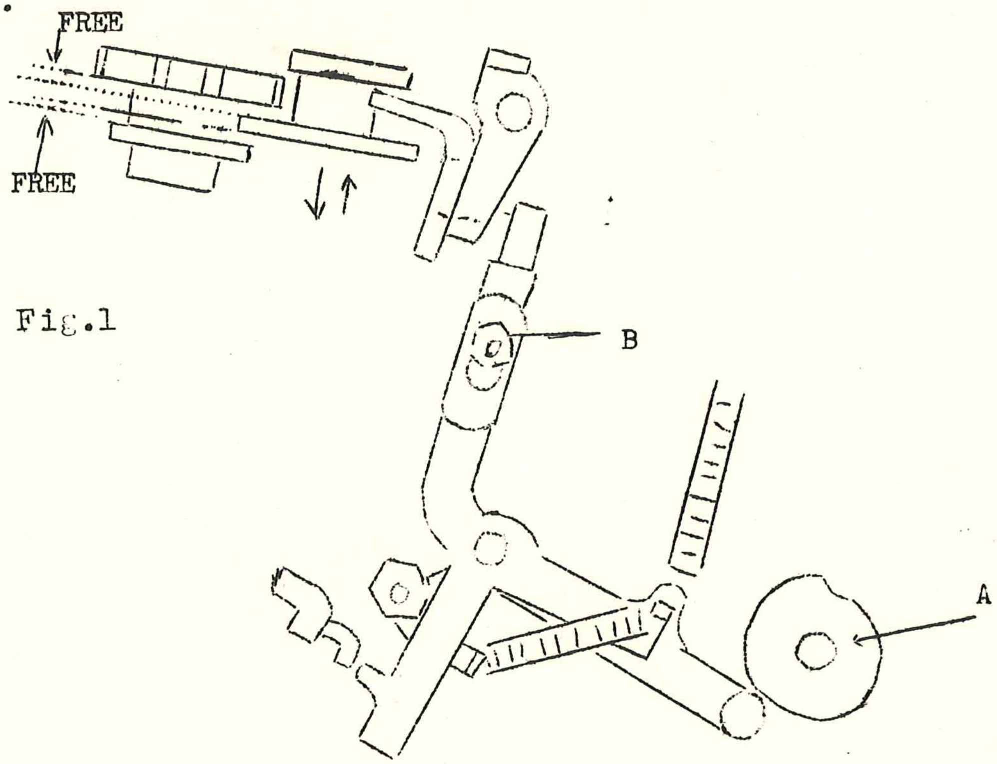


Fig.1

6. BLOCKOUT ARM FOR DIVISION:

(Fig. 1) In Home Position Eccentric Screw Stud (A) should clear bottom of Arm (B) .020--.030. Adjust by screws (C).
(Fig. 2) Machine in Division. Stud (A) should clear Arm (B) no more than .001. Adjust Eccentric Stud (A). VERY CLOSE ADJUSTMENT. (Page 12)

6. (Continued)

If adjustment is too wide in (Fig. 2) the Idler Gears can lower into mesh with the Transfer Teeth of the Large Gears and try to Transfer on the Overdraft or Restore Cycle.

If too close the Blockout will drag and may not move into place and again allow the Idler Gears to lower into mesh with the Transfer Teeth.

Test Machine in Division

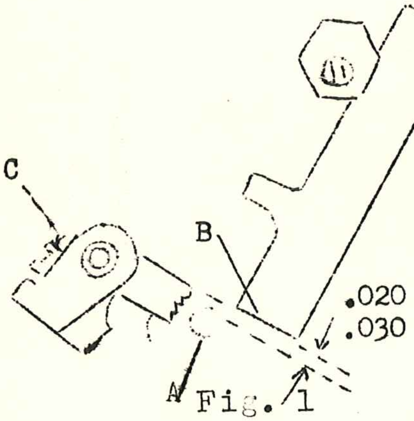


Fig. 1

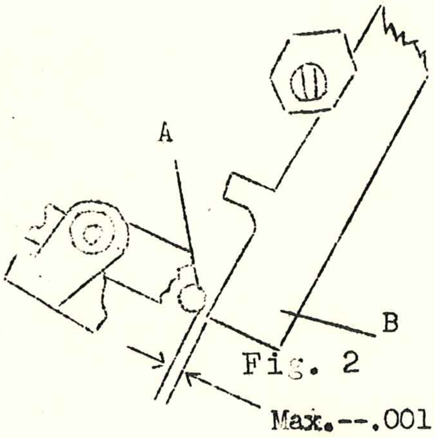
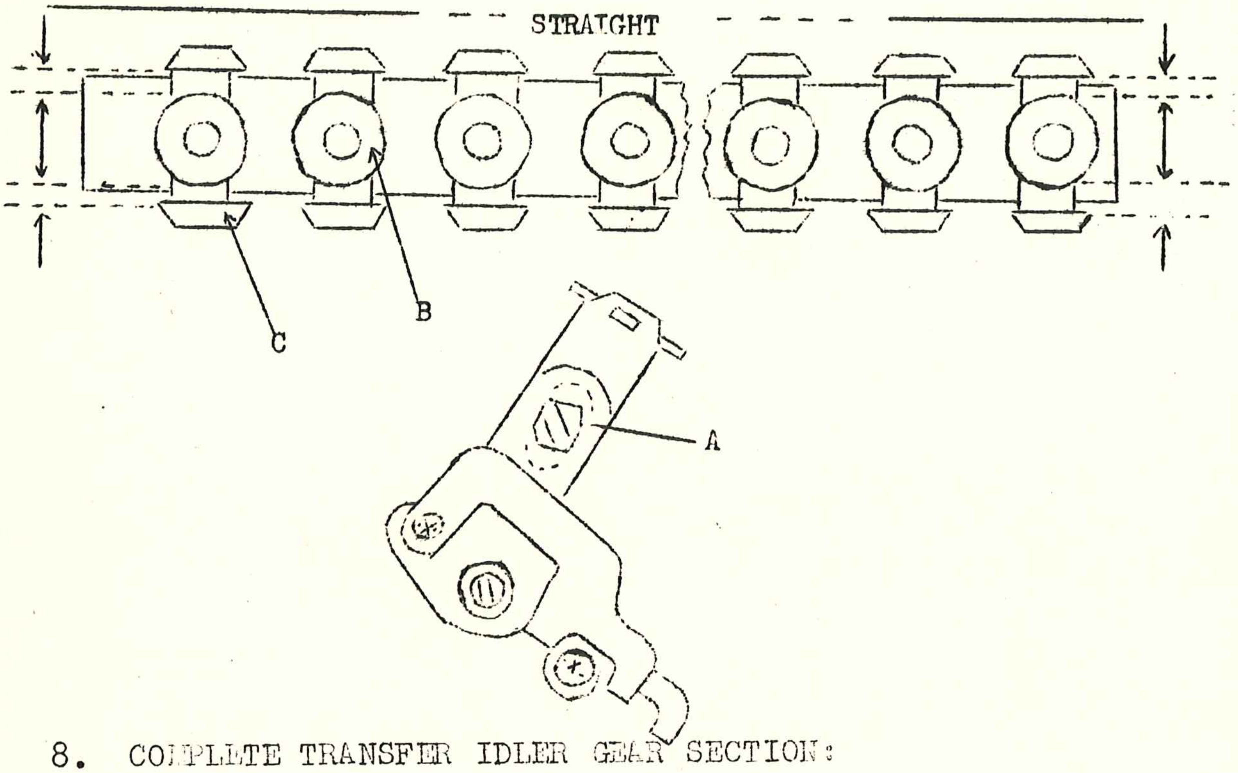


Fig. 2

7. ADD AND SUBTRACT GATE:

Eccentric (A) on Left End of Gate is adjusted to position Add and Subtract Gears (B) straight with the Dial Gears (C). (Page 13)
Looking through the Carriage, along the line of contact of the Gears, slowly mesh the Gears and observe that they contact at the same time along the entire length of the Add and Subtract Gate.

If the Gate is not straight this can effect the transferring of the the Complete Carryover Dials. Also can effect the correct entry of the figures in the Dials in Multiplication or other machine operations.



8. COMPLETE TRANSFER IDLER GEAR SECTION:

The Idler Gear Section located on the front of the Carriage Frame is adjusted inward or outward to control the amount of meshing the Idler Gears have with the Transfer Teeth on the Complete Transfer Dials. The proper meshing insures the proper rotation on each Dial by the other as the Transfer Action progresses across the Dials.
Place Carriage in First position. Place #1 in Last K.B. Column. Depress Minus Key, rotate by hand crank slowly and as the #12th Dials starts to turn observe how the individual Dials pick up as the Transfer Motion progresses Dial by Dial to the 20th Dial. Then depress the Plus Key and observe the same action as above when the Dials restore.

(Continued on Next Page)

If the Idler Gear Section is in too deep, there will be more interval between each Dial as they pick up on the Minus operation. On the Plus operation there will be less interval between the pick up of the Dials. (Fig. 1)

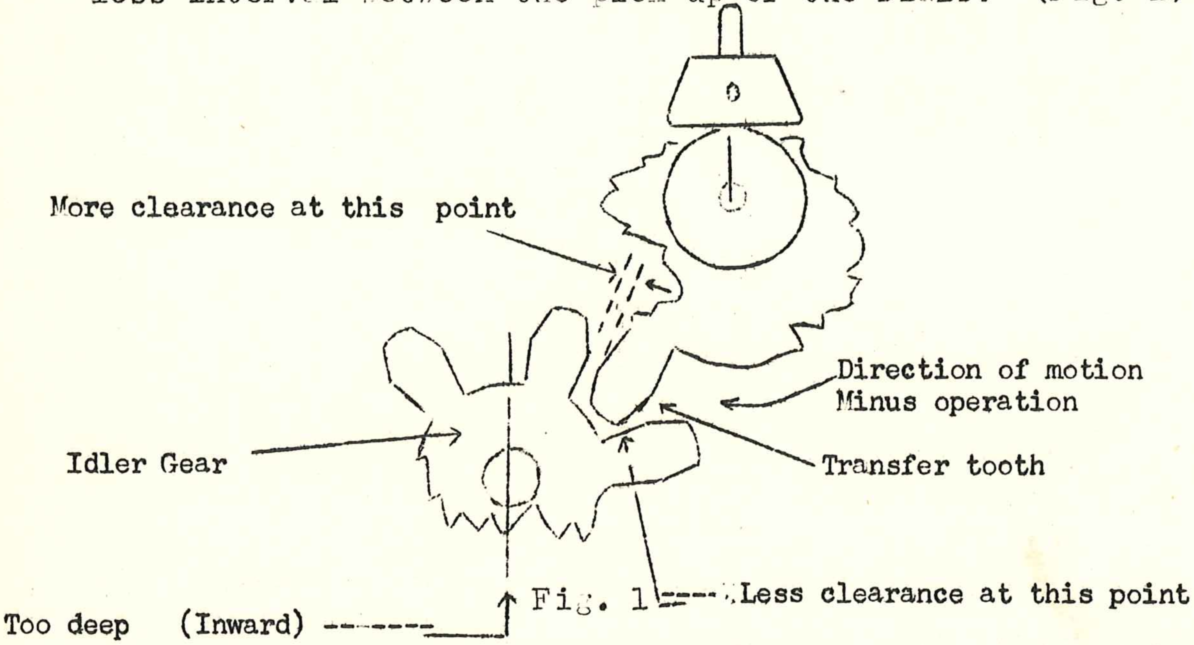

0
More clearance at this point
Direction of motion
Minus operation
Idler Gear
Transfer tooth
Less clearance at this point
Too deep (Inward)

Fig. 1

If the Idler Gear Section is not deep enough, there will be less interval between the pick up on the Minus operation. On the Plus operation there will be more interval between the pick up of each Dial. (Fig.2)

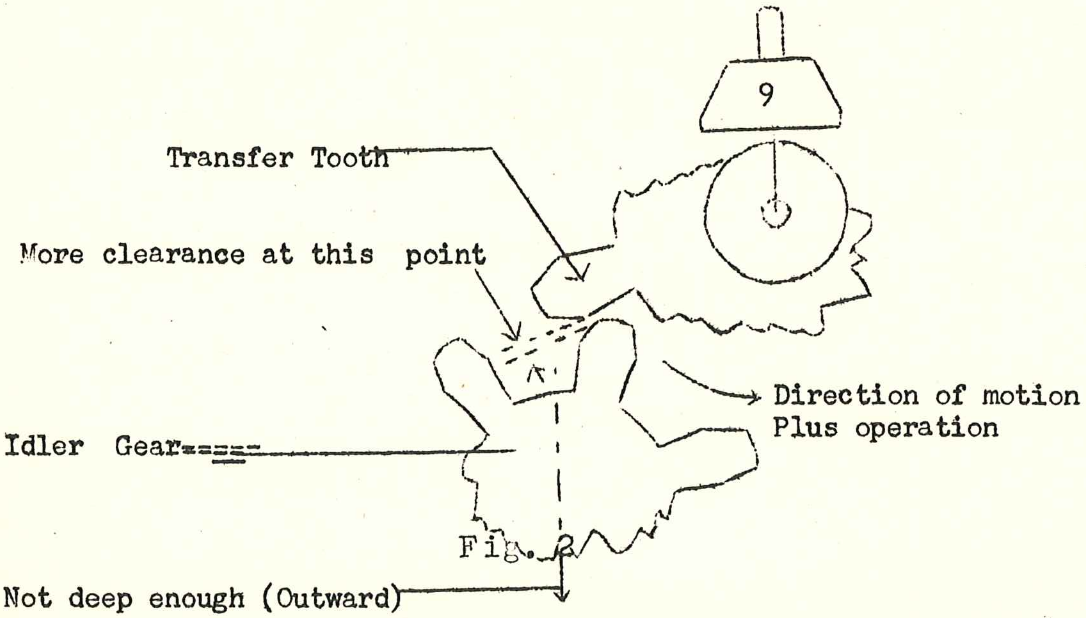

9
Transfer Tooth
More clearance at this point
Direction of motion
Plus operation
Idler Gear
Not deep enough (Outward)

Fig. 2

To adjust INWARD: Turn Allen Screws (A) and (B) OUTWARD and turn Screws (C) and (D) INWARD a likeamount. A turn of 1/12 will effect the meshing of the Idler Gears. DO NOT turn Screws (C) and (D) inward with pressure for this will distort the Bracket. (Fig. 3)

To adjust OUTWARD: Turn Screws (C) and (D) OUTWARD and turn Allen Screws (A) and (B) INWARD. Then turn Screws (C) and (D) INWARD LIGHTLY. Do not distort Bracket. Fig. 3)

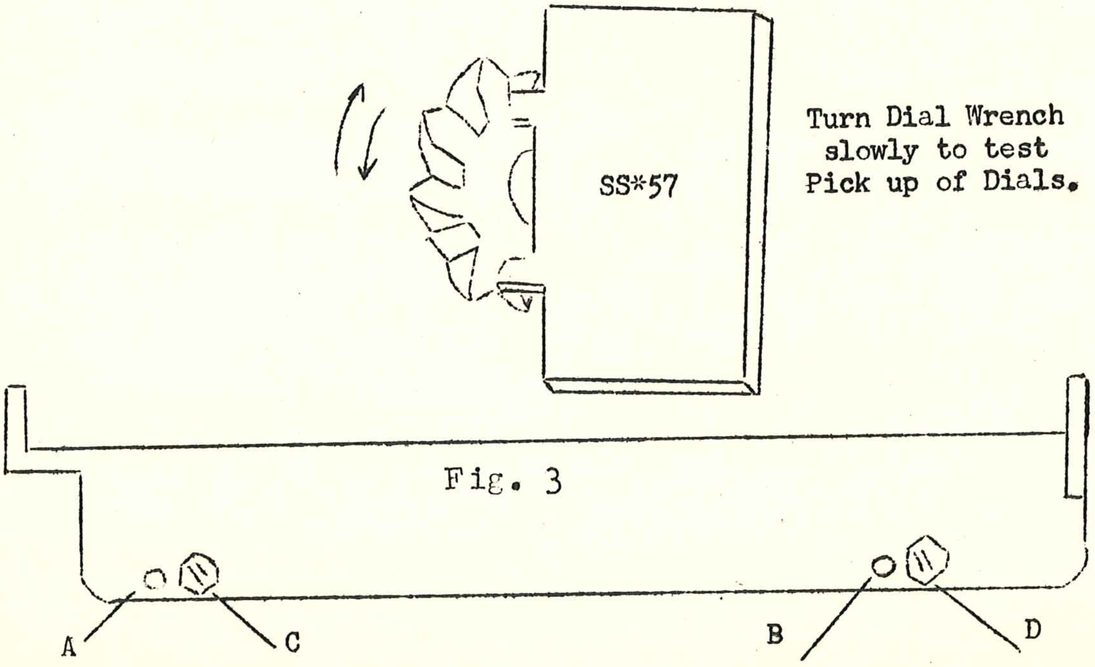
Keep Adjustment of Bracket EVEN. There should be an equal amount of backlash (or interval between pick up of the Dials) at both ends of the Idler Gear Section. It may be necessary to adjust at one end only.

In setting the adjustment use the Dial Wrench to turn Dials to test for the backlash, by turning the #12th Dials.

REMEMBER: IT IS BEST TO CHECK ALL OTHER ADJUSTMENTS BEFORE MAKING ANY ATTEMPT TO ADJUST THE IDLER GEAR SECTION. THIS IS SET AND SEALED AT THE FACTORY AND SHOULD NOT BE DISTURBED UNLESS NECESSARY.

Purpose of the adjustment: To give the Dials equal control or momentum as they all turn from (0) to (9) or from (9) to (0). If they do not have equal control the Dials at the extreme left end may not turn properly or may turn past the (9) or the (0).

BEFORE attempting any adjustment to the Idler Gear Section to correct the end Dials from spinning be sure the Carriage Shift Rack is adjusted properly. (Adjustment #9)



Turn Dial Wrench slowly to test Pick up of Dials.

Fig. 3

9. CARRIAGE SHIFT RACK:

To test the Carriage Shift Rack adjustment use a Push-Pull test. Push on Carriage and transfer (9's) in and out, then Pull on Carriage and repeat test. Do this in all Carriage positions. If the Dials tend to falter or to transfer improperly, adjust the Rack slightly in the direction indicated by the test. That is, if failure is noted when pressing the Carriage to the Left, adjust Rack to move Carriage to the Right slightly.

Purpose of Adjustment: To position Carriage so the #12th Add and Subtract Gear will turn any Dial in line with it with equal momentum. If this adjustment is off, the Complete transfer Dials will fail to record Zeros or 9's properly, sometimes #20 Dial will spin.

Test above by placing (1) in first K.B. column, Dials clear and operate Minus and Plus Key a number of times. Try in all Carriage positions. Also, use Negative Mult. Key then Accumulative Mult. Key by using (1) (10) (100), etc., in Unit. Try Several times.

10. CHECK #12 GENEVA FOR SLIPPING
.002 to .003 Clearance

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If Complete Transfer Dials are locked on Carriage Clear, check adjustments #1, 2, 4, 5. Dials may also have been half cocked before clear operation. Check Adjustment #8, 9, 10.

If Complete Transfer Dials fail to register properly, that is spin or fail to turn enough, check Adjustments #8, 9, 10.